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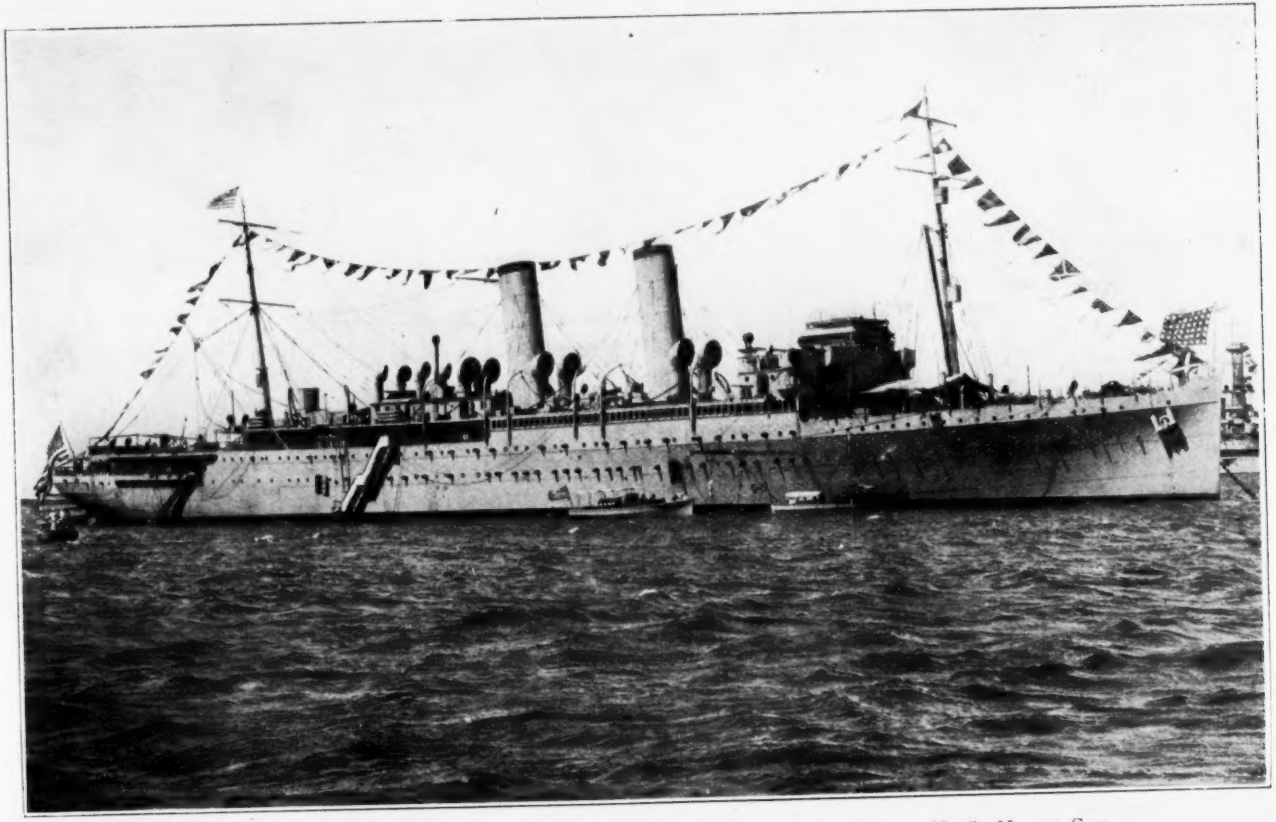

THE U. S. S. "COLUMBIA," FLYING THE FLAG OF ADMIRAL H. P. JONES, U. S. N., AS SHE APPEARED ON FEBRUARY 22, 1922, WHILE AT GUANTANAMO BAY, CUBA, IN THE CAPACITY OF THE ADMINISTRATIVE FLAGSHIP

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EMPLOYMENT AND TACTICS OF AIRCRAFT IN NAVAL WARFARE

By Commander John P. Jackson, U. S. Navy

The Place of Aircraft in the Military System

1. Throughout the Great War and up to the present time, ideas regarding the strategic and tactical employment of air forces in co-operation with land and naval forces, and as to the co-ordination of the operations of the many different types of aircraft amongst each other, can hardly be said to have crystalized. Aircraft, much as they were used in the Great War, were employed upon more or less detached raids, attacks, scouting and other operations,—sometimes alone, and sometimes in conjunction with land and naval forces,—and the relative proportion of aircraft to land and naval forces, and the proportion of various types of the craft themselves to constitute a well balanced air force, is still to be determined.

2. The exact place which should be occupied by the air force as a whole in the great military scheme in which the land and naval forces have definite and established places, determined through

Author's Note: Since the author is not an aviator many of the statements in this article regarding conditions in the air have been taken from the expert opinions of aviators, to whom acknowledgement is hereby made. The author's purpose is to collect the best available opinion and knowledge in such matters and show their effect upon the tactics of aircraft.

Appeared on February 22, 1922, while at Guantanamo Bay, Cuba, in the Capacity of the Administrative Flagship

long years of study and practical experience, has not as yet been settled. The very question as to whether the air force should be under a separate administration or be a part of the army and navy, is at this very moment unsettled and under discussion in the principal countries of the world.

3. The question has been a very live one in the United States, and great pressure and much propaganda have been brought to bear from certain sources to take the air forces away from the army and navy and consolidate them into a separate co-ordinate department.* The arguments for and against such a policy are strong and many, and an exhaustive consideration of them would call for a voluminous discussion which would expand this paper far beyond reasonable bounds. I shall content myself therefore with quotations from expressions of opinion of one officer from each of our services. On January 12, 1921, General Pershing, in answer to a letter, expressed himself in part as follows:

> Military forces can never be efficiently trained or operated without an air force.
>
> An air force, acting independently, can of its own account neither win a war at the present time, nor, so far as we can tell, at any time in the future.
>
> An air force by itself can not obtain a decision against forces on the ground.
>
> A military air force is an essential combat branch and should form an integral part of the army.
>
> If success is to be expected, the military air force must be controlled in the same way, understand the same discipline and act in accordance with the army command under precisely the same condition as other combat arms.
>
> An air force, as well as all other branches of the military organization must fully understand its exact functions in working with other branches, must know the needs of other branches, be in full sympathy with them, think in the same military atmosphere, and have the same *esprit de corps* in order that effective battle control may be established.
>
> No such force can realize the above conditions unless it be an integral part of the command not only during battle but also during the entire period of doctrinal training.
>
> To realize these conditions the different arms of the service must live together and train together.
>
> An air force should be established as a separate arm of the service, co-ordinate with the infantry, cavalry and artillery.
>
> The air force should not be established as a combatant force distinct from the army or navy.

*This article was written eight months ago.

4. By substituting the words "naval" for "military," and "navy" for "army" in the above quotation, and where he speaks of "infantry", "cavalry" and "artillery" by substituting the various branches of the naval service, General Pershing's opinion applies with as much force to the navy as to the army.

5. Certain officers of the U. S. Navy are as strongly opposed to having its air force removed from its control and jurisdiction, as is shown from the following quotation of an officer of the aviation section of the navy:

Aircraft considered from a purely naval standpoint will be of use in helping to gain command and to exercise command of the sea, but they never can be the determining factor. The big gun and large surface craft are the controlling factors in gaining command. Such craft (capital ships) combine mobility, protection and armament to the greatest extent. Supported by proper types and a train they can operate for long periods in an enemy area securing permanent local command of this area.

Aircraft possess great mobility but can not occupy an area permanently unless close to a base defended by the guns of ships, or the artillery or infantry of an army. Air control, while specially applicable to breaking up the control of areas either ashore or at sea, is less applicable to keeping permanent control, and, therefore, must base behind the other arms and is best used as an adjunct to the other arms.

Such being the case and military operations necessitating a unified command in which surface craft are maintained in areas supported by variety of arms—destroyers, submarines, aircraft, etc., it is obvious that aircraft at sea must be a part of the operating forces at the disposal of the commander-in-chief and the personnel and the type must be adapted and trained to meet sea conditions.

The seaman considers he has a special training and profession in which long training, drill and experience are required through a life time career. Conversely he has not assumed that he can tell other professions military or civil what their methods, tactics or strategy should be. He does not desire to encroach upon the province of the soldier or civilian as he assumes that each has a special profession. The use of a new arm such as aircraft at sea needs special types and adapting for application to the seaman's problem in securing and exercising control of the sea. Seamen and naval commanders familiar with naval practice, strategy and tactics are necessary in aircraft for naval purposes to fit in properly this arm with the other arms in developing mobile sea power.

I doubt whether in the future any Admiral on the navy list will care or dare to guarantee the national defense at sea if the naval air forces are detailed from another corps in which the personnel are dependent for development technically and professionally and for pay and promotion upon such other corps foreign to the navy, and in which the material is dependent upon the decision of officials outside of the service. This responsibility

for the national defense at sea is carried by officers of the navy and it cannot be shifted.

6. In addition to the military reasons against a separate air force, there are many considerations in the development of civil and commercial aviation which indicate that it is much more advantageous to have separate government organizations in control of the air forces of the nation than to have these consolidated into one. These arguments are even more voluminous than the military ones, and no attempt can be made to present them here.

THE CAPABILITIES OF AIRCRAFT

7. War as conducted on land and sea has, through centuries of practice and experience, laid down certain well known and immutable principles. In other words a doctrine for the conduct of war on land and sea has come to be recognized. The advent of aircraft has introduced elements so different from those hitherto employed, and whose capabilities are as yet so little appreciated, that an entirely new field has suddenly been opened up for the conduct of hostile operations, with possibilities which may well revolutionize modern warfare. As an example of the confusion of thought which at present exists, may be taken the present controversy between the aircraft and the battleship, which is raging throughout the world. Extreme adherents of the aircraft claim that the recent experiments in the United States have unconditionally rendered the most modern battleship obsolete. The advocates of the battleship, on the other hand, claim that its position as the backbone of a naval force is unshaken, and that a new weapon has merely been introduced, which must be guarded against.

8. The truth of course lies as usual between the two extreme views. It is far from proven that the battleship is obsolete, but on the other hand there is no question that a most serious menace to its existence has been brought into being. How far then is a nation justified in depending upon battleships for its defense? And to what extent should it develop its air force, not only as a menace to the land and naval forces of an enemy, but also to co-operate with its land and naval forces in their own defense and the defense of the nation itself?

9. This is a major question of military policy and strategy, and its solution depends upon the development of a sound doctrine

for the employment of air forces. Doctrine is merely the reduction to tangible form of the principles which govern action. To develop a doctrine for the air force therefore, we must investigate the capabilities of aircraft in relation to the recognized principles of warfare. And it is here that the difficulty arises. The capabilities of aircraft are so indeterminate on account of the rapid strides in improvement continually in progress, that it is practically impossible to say at the present moment what aircraft can or cannot accomplish, and whether they can even accomplish under war conditions what they are well known to be capable of in suitable weather and in time of peace.

10. As an example, it has been proven by the recent experiments that selected types of aircraft, tuned up for the occasion, and carrying the largest bombs yet constructed, can under ideal weather conditions sink an old type of battleship, stationary and defenseless, not more than 100 miles from the aircraft base—*if* they drop their bombs *exactly* where they desire. But alter any of these conditions and what can the aircraft do? Can it sink a modern battleship, specially constructed to resist air attacks, maneuvering at high speed in any kind of weather, and defended by efficient anti-aircraft batteries and numerous fighting planes of its own?

11. We have considered the ideal condition for the aircraft and the ideal condition for the battleship, and in each case can be reasonably sure of the answer. But what will be the result when the conditions are neither ideal for one side nor the other? Ideal conditions for any particular weapon seldom exists in war, and we must rate the value of any weapon upon its practical ability to function successfully under actual war conditions. The battleship will run a risk when conditions are not favorable to its defense; and the aircraft, by seizing the opportunity when most of the advantages are in its favor, may be able to make a successful attack. It is under these varying probable conditions that our knowledge of what can or cannot be done is so meager, and at the present moment we cannot do much more than conjecture. However, in the present state of rivalry between nations (and no nation is without its own particular rival), one cannot afford to await the complete solution of every unsolved military problem before deciding what kind of a military force to con-

struct. One must make the best possible conjecture as to the probable value of various means of defense, and then construct these in accordance with the most probable conclusions reached.

12. To form some idea, then, as to how much one should depend upon an air force, and what should be its size and characteristics, we must consider, with the best information available, the capabilities of modern aircraft, and estimate how much these capabilities will be increased at the present rate of progress. We must then study all types of aircraft which exist at present, their capabilities as shown by past performances, and the lines of development along which progress is leading. We can thus arrive at some conclusions as to what we may reasonably expect our air force to accomplish, and form a plan for the employment of the air force in war. This should include co-operation with land and naval forces, and co-ordination of the different types of aircraft themselves in the various operations of war. In this way a doctrine is formed for the conduct of air operations, which will form the basis upon which to construct our air forces. We can then determine what size air force we shall need, and the relative proportion of the various types to produce a well balanced force.

TYPES OF AIRCRAFT

13. A complete study of aircraft would of course fill volumes, and the mass of technical detail would end by obscuring the issue. Such a study is of course not contemplated here. The principal types will merely be enumerated, with their characteristics, advantages, and disadvantages in brief; and their capabilities will be assumed from their best known performances, to give us a basis upon which to formulate a tentative doctrine for the employment of aircraft in war, and to devise a system of aerial tactics.

14. Aircraft are divided into two main classes: Lighter than air, and heavier than air. Lighter than air craft are divided into dirigibles, free balloons, and captive balloons, of which latter type the kite is the most efficient for war purposes. Dirigibles are further divided into rigid, semi-rigid and non-rigid types and are constructed in innumerable sizes, from the Baby Blimp to the Zeppelin. They all have self-contained motive power and are capable of being controlled in speed, elevation and direction. Free balloons have no motive power of their own,

but are capable of movement with the wind. They can be controlled in elevation but not in direction. Captive balloons have no motive power, and are incapable of movement, except that they can be controlled in elevation by power outside of themselves.

15. The largest dirigibles must above all have endurance and ability to keep the air under adverse conditions of weather. Their speed and climbing power are moderate. Smaller dirigibles have these qualities correspondingly decreased. Free balloons are of no practical use in war. Kite and other captive balloons are used for observation purposes and control of gunfire. They must offer a reasonably good platform and be capable of being quickly hauled down.

16. Dirigibles can operate only from the shore, and therefore cannot be counted on for reliable use with the fleet. This was demonstrated at the Battle of Jutland by the failure of the German Zeppelins, in spite of the proximity to their bases at which the action took place. Kite balloons can be used advantageously from the decks of large ships, for observation and spotting purposes, and it would seem that at least one ship in each division of capital ships should be equipped to carry them.

17. Heavier than air craft are almost infinitive in type, size, and characteristics, but can be divided according to their uses into a relatively small number of principal types. They can best be considered under the uses for which they are designed.

METHODS OF EMPLOYMENT

18. The employment of aircraft in war can be grouped into the following main divisions:

1. Securing command of the air.
2. Scouting, reconnaissance, and patrol.
   (a) Photography.
3. Fire control, observation, and spotting.
4. Protection of the fleet.
   (a) Smoke screens.
5. Attack on enemy surface and sub-surface craft.
   (a) Illumination.
   (b) Bombs, torpedoes, and guns.
   (c) Gas attacks.

6. Escort of convoys.
   (a) Submarine and mine search.
7. Dispatch carrying.
8. Transportation.
9. Evacuation of the wounded.
10. Control of operations from the air.

19. Of these the first is most important, just as it is with a fleet on the sea, and its successful accomplishment facilitates all of the other duties of aircraft listed below.

AEROPLANES WITH THE FLEET

20. There should be at least one large plane carrier with the main body and one with the principal scouting force. In addition every large ship—that is, battleships, battle cruisers and scouts—should carry one or two planes. The ideal would be of course to have enough planes on warships and plane carriers to secure indisputable control of the air, and this should be the objective striven for. Since the number of planes which can be carried on regular warships is necessarily restricted, the number of plane carriers must be increased to attain the desired end. On cruisers which carry but one plane, this should be a scouting plane. In capital ships which carry two planes, one should be an observation plane and one a combined fighter and light bomber.

21. For practical operations the proportion of types depends naturally upon the enemy's air force, and upon the actual conditions it is expected to encounter. In general, there must be enough pursuit or fighting planes to control the air in any probable situation which may arise. Each capital ship must carry its own observation or spotting plane. There must be enough scouts to keep informed of the enemy's movements. Then, the rest of the carrying space available can be given up to bombing and torpedo planes.

AUXILIARY CHARACTER OF THE AIR FORCE

22. Before considering the tactics of aircraft, it is desired to invite attention to a fact regarding the character of air forces, which it will be well to bear in mind. An air force at the present time is essentially an auxiliary force. As General Pershing states, it cannot, acting independently and on its own account, either win a war at the present time, or obtain a decision against forces on

the ground. The same may be said of the sea. Securing command of the air is thus an operation of a somewhat different character from securing command of the sea. At the present time it but facilitates the accomplishment of the preliminary operations necessary and leading up to the securing of the command of the sea. In a sea campaign, therefore, we must consider the air forces merely as any other part of the auxiliary or minor forces, such as destroyers and submarines, scouting vessels, etc.; and in no case must we invest them with the attributes of a main fighting force; which attributes the battle fleet, and it alone, possesses.

AIRCRAFT REGARDED AS PROJECTILES

23. We might even go a step further, and instead of classifying aircraft as a part of the auxiliary forces, class them as long range projectiles. Since the range and endurance of aircraft is not sufficient to permit them to control the command of any extensive area of sea or land by themselves, they must have a base close at hand from which to operate and to which to return when their endurance is exhausted. The base may be an air station on shore or a plane carrier at sea. The air station on shore is thus analogous to a battery of high powered long range guns, and the plane carrier is analogous to the capital ship. Each is an establishment for the hurling of projectiles against the enemy.

24. Considering aircraft in this light their effect upon the tactics of warfare can be estimated. The aeroplane is nothing more than a projectile of much greater range than the shell from a heavy gun, or the torpedo; capable of being aimed and otherwise controlled during its flight, and if not destroyed, of returning to its base after its attack; but also susceptible of being intercepted and stopped during its flight before it reaches its target. The obvious tactical result of the great range of aircraft considered as projectiles is to increase tremendously the battle range between opposing forces. An air station ashore or a plane carrier at sea protected by other forces to the best possible degree from every known kind of an attack, can launch its projectiles (aircraft) against an enemy distant many times the range of visibility.

25. The controlability, however, of the aircraft projectile during flight, and its susceptibility of being intercepted, introduce new tactical elements in the employment of this method of striking the enemy. Unlike the shell and the torpedo which after leaving the gun and the tube proceed automatically toward the target unguided by human skill after the initial aim and adjustments have been made, the aircraft remains under the control of human intelligence until it delivers its attack, is destroyed, or driven off. The enemy also sends out similar weapons under the same kind of control to prevent it from accomplishing its mission. What is really a battle of projectiles then ensues to determine whether the target shall be reached or not.

PLANE CARRIERS AS CAPITAL SHIPS

26. The greatly enhanced importance of the plane carrier becomes obvious, viewed however not as an element designed solely to facilitate the acquisition of the command of the air, but rather as a capital ship of the sea fleet carrying projectiles for attacking the enemy's main force far outranging those of the present battleship. In other words, aerial development will have the effect of adding a new type of capital ship to the sea fleet. In order to use this type the command of the sea is still of vital importance.

27. From its very nature and the requirements of the aircraft which it is to launch as projectiles, this new type of ship—the plane carrier—will not be able to defend itself against the attack of hostile battleships. Just as a battery of heavy artillery on shore must be protected against capture by the employment of light artillery, machine guns, and trench mortars, so must the plane carrier at sea be protected from enemy surface craft by battleships and other sea types.

28. The ideal of course would be to combine the plane carrier and the battleship into one all powerful vessel, with the ability to gain command of both sea and air. As this is obviously impossible we must recognize the advent of the new type of capital ship without discarding the old, and the backbone of the modern fleet will consist of both types—the plane carrier and the battleship. Just as the battleship was formerly the target for attacks by destroyers and submarines, so now the plane carrier and battle-

ship will be subject to these attacks and, in addition, to the attacks of aircraft. It cannot be seen from present accomplishments, that the broad principles of naval warfare have been upset, but merely that the tactics have been altered by the introduction of a projectile of very much greater range and controlability, and the opening up of the third dimension to hostile operations.

29. The recent experiments against the old *Alabama* of the American navy show up much that is startling in the possibilities of poisonous gases, flares, and smoke screens launched by aircraft against surface craft; but it must be remembered that these were conducted against an inert target; just as the former experiments against the old German ships were. Undoubtedly the side which gains complete command of the air can inflict terrific punishment upon its adversary, but the same may be said of the side which formerly had gained undisputed command of the sea. In the future, command of the sea and command of the air must go hand in hand, and until aircraft as stable and of as great endurance as seacraft are developed, it is difficult to see how either can be gained or maintained without the presence of a sea fleet.

30. Furthermore, even if it is granted that aircraft can safely protect the entire coast and hold seacraft at a distance of 200 miles therefrom, as has been claimed, this is purely a defensive measure. To win, offensive tactics must be pursued. How can aircraft by themselves carry the war to the enemy's coasts, maybe thousands of miles away? It is inconceivable that they can, without the escort and support of a sea fleet. This fleet must be of the most powerful and include battleships, or it can be destroyed if the enemy has more powerful ships to send against it. In any way that the subject is approached, it is impossible to get away from the absolute need of the battleship as the backbone and main support of all other types of craft designed to fight on, under, or over the sea.

NATURE AND CONTROL OF THE AIR

31. Securing command of the air, then, is an operation analogous to an action between the light surface forces of opposing fleets to get local command of such area as to permit of driving home a reconnaissance, of carrying on distant scouting, or to

facilitate minor attacks upon the enemy main force. It is for these same reasons that command of the air is sought. The advent of aircraft has merely opened up another plane for the conduct of hostile operations, just as the development of submarines did. And no more than did the submarine, can the aircraft take the power of decision away from the heavy fighting units of the surface fleet. When a submarine battleship is developed, the power of decision may pass to it from the surface battleship. So also when an aircraft of equal power, endurance and stability to the surface battleship is developed, the obtaining of a decision may be transferred from the surface of the land and sea to the air. Such an event is for the far distant future, if ever; and until that time, we are not justified in considering air forces as anything more than auxiliaries and adjuncts to the fighting forces of land and sea.

32. Thus far the mission of aircraft is to assist the naval and military forces in the accomplishment of their missions rather than the accomplishment of any major operations of their own. With this clearly in mind we are in position to develop the tactical use of aircraft and show how they can be of the greatest use in the conduct of war. The first use to which aircraft would probably be put in war would be scouting and reconnaissance. But just as the light surface forces must secure the local command of a definite sea area in order to do effective scouting and drive home their reconnaissances, so must the aircraft secure at least a temporary command of the air in the locality where their scouting operations will take place. We may then well begin with a consideration of the first of the enumerated uses of aircraft in war, not only because it is the most important, but also because at least to a limited degree it is the first use to which they will be put.

SECURING COMMAND OF THE AIR

33. To secure command of the air, the enemy's aircraft must be destroyed or driven out of the air. To accomplish this an adequate number of planes of high speed, great offensive power against any type of enemy aircraft which they may encounter, and comparative invulnerability, in whatever manner this is secured, must be employed.

34. These requirements resulted in the development during and since the Great War, of a type of plane known as the pursuit or fighting plane. Its general characteristics are briefly as follows. It must have speed from 120 to 160 miles per hour, and in the future probably these speeds must be increased. It must carry as many weapons as possible to inflict damage upon the enemy. At present two to four machine guns are carried, the number being limited by size and other considerations necessary to obtain the remaining requirements. There is at present no need for more or larger guns, since its antagonists are entirely vulnerable to the present weapons. As defensive qualities are improved, however, the near future may well require fighting planes to carry three-inch guns or even larger. To secure an advantageous position from which to attack it must have great climbing ability. In the past this has been between 9,000 to 12,500 feet in ten minutes. It must be able to outclimb any other type of machine which it may encounter. For the same reason, and to attain invulnerability through its power to elude, it must be a quick maneuverer. This sets a limit to its size, which in turn offers a smaller target to the enemy. The spread of wings thus usually runs from thirty to forty feet, which makes it one of the smallest machines used for war purposes. It carries a crew of one or two men, but possible future development of its armament may require more.

35. As to the broad tactics of fighting planes, they should be sent out in large numbers upon arriving in a region where it is expected to encounter hostile aircraft. If these latter are actually in sight, the fighting planes should be sent out in advance of any other type to drive them away. Otherwise, they should follow up the scouting planes, whose radius of action is much greater, and be in position to support them if they are driven in. Their mission is essentially to secure command of the air and to support and protect all other types of aircraft and surface craft as well, against the attack of hostile aircraft. Their tactics in co-operation with other types will be considered in connection with the uses to which these other types are put.

36. Their combat tactics have heretofore varied almost with the whim of the individual pilots. Each ace and famous birdman of the recent war had his own particular style and method

of fighting. It is about time that some approved principles for combat in the air became crystalized. In general the tactics consisted in maneuvering to bring the opponent under a quick intense burst of machine gun fire while keeping out of the arc of his fire. The maneuvers obviously depend upon the number and type of guns in the opposing aircraft, and the method of mounting these. The propeller is the greatest factor tending to limit the arc of fire. Guns cannot fire through the propeller unless they are synchronized with it or fire through the propeller shaft. In these cases the guns are fixed and can only be aimed by pointing the craft itself, which necessarily greatly hampers its possible maneuvers.

37. During the recent war, fighting planes carried only one or two small guns and the methods of mounting these were very much restricted. This will be referred to later. With development, particularly in the size of aeroplanes and in the various methods devised to eliminate dead angles, it is pretty certain that in the future, fighting aircraft will have guns so mounted as to cover all arcs. The problem will be to devise a system of mounting capable of delivering the maximum fire in all directions, just as the center line turret system does for ships. Until aeroplanes are armored, there would seem to be no reason for carrying anything larger than machine guns for use against other aircraft; but recent developments indicate the feasibility of mounting cannon up to as large as three-inch. For the present these would only be used against ships or ground forces, and will be referred to later.

SCOUTING, RECONNAISSANCE, AND PATROL

38. The first use to which aircraft were put in war was scouting and this still remains one of the most important. Aircraft are the eyes of the fleet to a much greater extent than surface scouting craft can be, and are used in two ways. First, small short-range machines flown from the decks of scouting vessels themselves to increase the scouting area covered by the latter; and second, large long-range machines flown from specially constructed carriers, or from bases on shore, for independent distant scouting and reconnaissance.

39. When flown from scouting vessels planes are used either to cover the area between the vessels of a scouting line, thus permitting the distance between these to be increased, and extending the area searched laterally; or they can be sent out at daylight and before dark to cover additional areas backward and forward in the direction of the course of the scouting vessel, thus increasing the area searched along the axis of the search. The range of vision of aircraft varies of course widely according to atmospheric conditions, as well as does their visibility from other craft. Cases are known of their having seen ships at sea clearly for thirty miles, and the smoke of large cities at ninety miles; whereas at times while spotting from directly over a target, they could not see the firing ship at all due to peculiar haze conditions, although the latter could see the target.

40. Most of these atmospheric conditions affect scouting vessels as well as aircraft, and the conduct of a search must be altered to suit them. Often there is a haze at moderate altitudes whereas there is none on the surface of the sea and vice versa, and advantage must be taken of the best existing visibility. The visibility of aircraft from other craft depends as much upon the light conditions, direction of the sun, background, etc., as upon the haziness of the atmosphere. Since scouting aircraft should if possible keep themselves concealed from the enemy, advantage may be taken by a skillful pilot of different combinations of weather conditions to see without being seen.

41. As to the tactics of small scouting planes, there is not much to be said. They must of course elude or retire before fighting planes and other types more powerful than themselves. The chief care should be to scout the assigned areas thoroughly, leaving no unsearched spots; and to this end as well as in order to be able to pick up the mother ships again, the greatest attention must be paid to their navigation. For long distance independent scouting, aircraft are far superior under good weather conditions to surface vessels, on account of their greater speed and vision, which enables them to cover an area many times larger than a surface vessel can do in the same time. Sea planes are in existence with a radius of 1,200 miles. With a speed of sixty miles an hour or more, it is easy to see what immense areas can be covered in a few hours, which it would take surface vessels days to get

over in addition to the complications introduced by periods of darkness. Dirigibles are especially adapted to this work on account of their very great radius of action. But they are visible long distances, are extremely vulnerable, and cannot be employed in the face of effective aerial opposition, at least not until the use of helium or some other non-inflammable substitute for hydrogen is found practicable, and some form of protection against gunfire developed. Large dirigibles, also, can only be employed within radius of their bases, and hence are unavailable to a fleet on a long distance oversea expedition until some sort of an operating base for them is captured. They are moreover very liable to be disabled by adverse weather conditions.

42. Of course in all distant scouting the difficulties of aerial navigation must be thoroughly appreciated. On account of air currents whose force and direction is unknown and which differ at different altitudes, dead reckoning is of practically no use. Astronomical observations are difficult to take and untrustworthy, due to the inaccuracy of estimating the height of the eye, and the discomfort and exposure of the observer. Navigation by landmarks, akin to coastal navigation, is the only thoroughly reliable method, and of course this is not available when out of sight of land.

43. In general, the same methods of search available to surface craft are at the disposal of aircraft; but due to the difficulties of navigation mentioned above, complicated schemes involving the various methods of the retiring search curve should not be attempted. Only the simplest forms of search, involving direct courses, should be tried; and if not in sight of land, the position should be checked as frequently as possible by sighting surface vessels from whom accurate positions can be obtained by radio. After the existing weather conditions as to wind currents at various altitudes, etc., have been determined by a series of short observation flights, the planes should be sent off by squadrons in sufficient number to completely cover the desired area. The plan of the search, including the exact position of the starting point, its extent, courses to be followed, etc., should be carefully made in advance, as well as a summary of the information it is desired to collect. If it is expected to encounter aerial opposition at not too great a distance, the scouting planes must be preceded or followed and supported by fighting planes.

44. The tactics of scouting planes on a search should be very much like that of the light scouting forces of the sea fleet. Depending on the character of their immediate mission and its urgency, they must be prepared to fight for their information, and if there is a good chance to pierce the enemy's aerial screen they should not hesitate to do so. If opposed by too great force they must retire upon their fighting planes in the same manner that light scouting vessels retire upon their supporting force. When sufficient power has been concentrated another attempt should be made to pierce the hostile air screen. So much for operations within the radius of action of fighting planes, which is small.

45. There is this difference between aerial and surface scouts, however. While the surface scout is usually faster than its supporting force and than the enemy vessels powerful enough to destroy it, the reverse is the case in the air. The so-called scouting plane has a large radius, but a comparatively low speed; whereas the fighting or pursuit plane has a small radius but high speed. This precludes the escape of a scouting plane discovered by enemy fighting planes out of supporting distance of its own fighting planes. Its tactics while scouting beyond the radius of its own fighting planes must therefore be quite different from that of surface scouts. It must depend upon concealment for safety. Since planes can see and obtain valuable information much farther than they can be seen, they can approach enemy positions or vessels with comparative impunity. If their presence is not suspected, only a sudden chance contact with enemy fighting planes can imperil them; since it would be impracticable for the enemy to keep a continuous patrol in the air with such short distance between units as to insure the discovery of every approaching hostile aircraft.

46. The tactics of slow long distance scouts thus reduces itself to concealment, and the pilot must be expert in taking advantage of weather conditions to remain unseen and yet be able to see himself. In clear weather, scouting at high altitudes, with great distance between planes of a scouting line, covers the greatest area in search for surface craft. In searching for submarines the altitude ought not to be over 1,000 feet and the distance between planes a few thousand yards. It is often necessary to come down if the visibility is poor, or in order to get under clouds, and some-

times it is necessary to rise over a rain squall in order to maintain vision all around it.

47. Fog of course puts an end to all search, just as it does for surface craft; and in addition may cause the plane to get lost. Fog should therefore never be entered if it can be avoided. If it cannot be kept clear of, a landing should be made before it closes in, if possible. If it is necessary to continue flying through fog, snow, or heavy rain, different altitudes previously agreed upon and differing by at least 500 feet should be taken by the planes of a scouting line to prevent collisions. Scouting at night is useless just as for ships, except to gain information of what is going on at some fixed positions where activities are in progress under bright artificial light. Under these conditions planes can come down very low without fear of being seen. The danger is of being heard, but this also is minimized if the industrial activity is such as to produce sufficient other noises to drown the noise of the plane's exhaust.

48. In approaching hostile positions or vessels, the direction of approach should be carefully chosen as regards sun, background, silhouette, etc., if the direction of the wind and other governing conditions permit. The NC-4 in approaching Lisbon on its flight across the Atlantic, is said to have been picked up at a distance of about twenty miles, being silhouetted against a western sky at sunset. High land or low cloud backgrounds, sun-glare and haze, render planes very difficult to pick up, just as they do ships.

49. So much for visibility. Audibility is almost as dangerous in disclosing the presence of aircraft and the potent factor is of course the motor exhaust. It can be somewhat deadened by approaching up the wind, but until it is found practicable to muffle the exhaust of aeroplane engines, this will continue to be a give away of an aircraft's presence.

50. For reconnaissance, as distinguished from scouting, dirigibles are best suited, on account of their ability to stop and hover over one spot while details are observed. It is evident how incomparably more accurate such a reconnaissance would be in regard to such details as size of guns, contours of defensive works, roadways, relative distances and directions, etc., especially if camouflage is employed; than a reconnaissance depending upon

the fleeting glimpses from an aeroplane darting over the locality. For long distance reconnaissance beyond the radius of aeroplanes, dirigibles are the only available aircraft. Their vulnerability, however, must be constantly kept in mind. They cannot be used where aeroplanes will be encountered in force.

51. In the recent war, photography from aircraft was much used. Both plane and dirigible can be equipped for this service, but the former is probably the more efficient as it can work faster, thus enabling it to take a series of photographs of any desired area, and views of the same object from different angles, much more rapidly than dirigibles.

52. Patrol may be regarded as a form of scouting, usually in the vicinity of one's own force or bases, to insure the early discovery of the approach of enemy forces. The patrol of such areas should be systematic and regular, constituting a part of the daily routine. For this use planes should have good endurance at cruising speed, and high speed is not essential. Small dirigibles can be used advantageously.

FIRE CONTROL, OBSERVATION, AND SPOTTING

53. The use of aircraft for fire control, observation, and spotting will next be considered. For these uses several types of aircraft are employed,—the kite, the dirigible, and the aeroplane; and there can be no question that the efficiency of fire controlled from aircraft is immeasurably superior to that controlled from a position on board the ship. Spotting from shipboard cannot be accurate at ranges of more than 18,000 to 20,000 yards; whereas from aircraft, spotting is efficient up to the maximum range of any naval gun yet developed, and the fall of shot at any range can be observed far more accurately than from the ship. Furthermore aircraft are not interfered with by the blasts of the guns, vibration, spray, the enemy's fire, and other confusing local conditions on board ship. They can spot over smoke screens, low lying mist, and beyond the horizon as seen from the ship. Except the kites, they can take position so as not to be affected by funnel smoke and gases, and sun-glare.

54. Kite balloons have the great advantage of direct telephone communication with the ship, but their many disadvantages outweigh this. They give away the exact location of the ship,

which otherwise might be obscured by smoke, mist, etc. They hamper the handling of the ship, require considerable attention from those on board, and in case of being shot down might add immeasurably to the general wreckage. They have a bad whip when salvos are fired and are thus not as good spotting platforms as other aircraft. Above all their position can only be varied in height, and they cannot thus seek the best positions for observation as other types can. They are subject to much of the same interference as the ship spotters. They cannot be used in bad weather and are very vulnerable to attack by hostile aircraft.

55. Dirigibles are in many respects the best type of aircraft for fire control. They make good platforms and are roomy and commodious for the observing personnel. They can slow down and stop, thus maintaining themselves in the best position for observation, whereas planes must keep moving at high speed. But they are susceptible to bad weather and are very vulnerable to air attack, as well as furnishing a large target for the gunfire of ships. Worst of all they cannot be counted upon as always available, since they cannot accompany a fleet at sea indefinitely, but can only operate within their radius of action from some fixed base on shore. Thus the dirigibles may not be present when most needed, if it happens that the theater of operations does not contain a dirigible base within radius of action of where the opposing fleets make contact.

56. Planes are therefore probably the most reliable and dependable type of aircraft for spotting purposes. They can go up in almost any kind of weather, are better spotting platforms than kites, and have all the advantages conferred upon them by mobility in selection of position for observation, etc. They can, before the action begins, report the movements of the enemy over the horizon or behind smoke screens, thus permitting fire to be opened at the earliest practicable moment. This is important with the modern long range gun, which can fire much further than its shots can be accurately spotted from the ship. The great disadvantage of planes which is not shared by kites and dirigibles, is that they must keep going at high speed throughout the entire time they are spotting, which in a prolonged action when reliefs cannot be furnished, subjects the personnel to great strain.

57. Kite balloons are so restricted as to action that there is not much room for a choice of tactics. They stay on the job as

long as possible and can vary their altitude somewhat to secure the best conditions for observers. But other than that they are helpless and defenseless. Dirigibles should keep in the vicinity but well above the firing ship. They must of course keep entirely clear of the trajectory of the projectiles, as must also planes, and cannot therefore go very far between the firing ship and the target. To fly over the target would be too hazardous in view of their vulnerability. If attacked they must take such steps to beat off the attack or make their escape as they would under any other circumstances, without, unless unavoidable, leaving their station until some other means of spotting can be resorted to, and for as short a time as possible. Defense should generally be left to friendly fighting planes.

58. The tactics of planes in spotting, which have so much greater freedom of action than the other types of aircraft, are more capable of elaboration. Their first care must be to keep in such position that the observer can see the target uninterruptedly, unobstructed by the interposition of wings, tail, etc. The altitude should in general be from 1,000 to 5,000 feet so as to obtain the best visibility conditions. They must keep out of the trajectory of the projectiles. As the maximum ordinate of the 14″/50 caliber gun is nearly 5,000 feet, at 20,000 yards range, and over 7,000 feet at 25,000 yards, the danger can be seen of getting midway between firing ship and target. To take position over the target would expose the plane to destruction by hostile action, and possibly prevent its getting back in case of need, through the trajectory of the guns of its own side. It is best therefore to remain in the vicinity of the firing ship, and maneuver to pass over it, flying towards the target at the instant the first salvo is fired. The plane should then turn at right angles and fly back and forth in front of the firing ship in a sort of figure 8, always turning toward the target so the observer will not lose sight of it. As each salvo is fired the pilot must turn the nose of the machine slightly toward the target so as to prevent the observer's vision from being obscured by a wing.

59. Primary communication except in the case of kites is by radio telephone. The plane should be warned before the first salvo and thereafter the word "fire" sent out at the instant of firing. Visual signals constitute the secondary system of com-

munication. Flags or streamers are used, different colored smoke puffs, or prearranged maneuvers of the plane itself. The secondary systems are slow and not very flexible, but the radio telephone is quick and accurate and the corrections from a plane should be in as soon as the ship spotter's.

60. There is a type of aircraft thus far little developed which has the promise of being an ideal machine for fire control and observation. This is the helicopter. With propellers of sufficient lifting power and for motion in horizontal translation, the helicopter could make headway or hold its own against the wind, and thus remain stationary in midair or move to any desired point. Such a type would have all of the combined advantages of the plane, the dirigible, and the kite, with practically none of their disadvantages. In addition to its ability to hover, its chief advantages are the ease with which it can be handled from the deck of a ship, especially as compared to the cumbersome kite or dirigible; the absence of the inflammable gas essential to these two types; and its invisibility and invulnerability as compared to them.

PROTECTION OF THE FLEET

61. The fourth use for aircraft to be considered is the protection of the fleet. Protection may be considered under two heads: warning of the approach of hostile craft of the air, sea or sub-sea; and the destruction or driving off of such craft. The types of aircraft needed for warning will be different from those needed to destroy or drive off the enemy. And also, the types needed to combat hostile aircraft will be different from those needed to combat surface craft or submarines. In fact, for the task of protecting the fleet practically all types of aircraft will be needed. The various duties of the protective force and the types needed for each will now be considered.

62. For protective scouting, planes can be used to a limited extent, but dirigibles are more efficient on account of their ability to remain in the air for much longer periods, and to stop and regulate their speed more easily to that of the fleet. The difficulty of maintaining large rigid dirigibles with the fleet far from their shore bases would practically preclude them from this duty. Small non-rigid types such as the Baby Blimp would be good craft for this work, provided the problem could be solved of

caring for them. This use of dirigibles as protective scouts is merely suggested as a possibility of the future. If their value in this capacity is thought to be sufficient, the problems involved might be found possible of solution. Or a new type, intermediate between the plane and the non-rigid, might be developed possessing some of the ease of handling of the former with the endurance and stability in the air of the latter.

63. In any case it cannot be seen that dirigibles possess any great advantages over surface craft for protective scouting, except speed and greater radius of vision due to their higher altitude. They would be efficient for picking up enemy surface craft; but since they can be seen by submarines much further than they can see them, no submarine would have any difficulty in keeping out of their sight by submerging. While it is true that they can see below the surface under certain conditions, deeper than surface craft, this distance is very limited even under the best conditions on the high seas, and submarines can always avoid detection by submerging deeply enough. Against aeroplanes they would be helpless since the latter are greatly their superiors in speed and invulnerability. From such distance as they could see hostile aeroplanes they could be overtaken and destroyed before they could either get back to the protection of their own forces or be supported by their own fighting planes, unless these were present with them; in which case they could as well do the scouting themselves and there would be no need of the dirigibles at all.

64. For gaining information of the presence of submarines, hearing must be depended upon rather than sight. The listening devices of surface craft are the best although not a certain means of detecting submarines. In this respect ships are superior to aircraft for protective scouting against submarines; and since dirigibles are helpless against enemy aeroplanes, the only advantage they possess over ships for protective scouting in general is the greater distance they can see enemy surface craft. This advantage is hardly sufficient to warrant the risk of loss attending their use, and hardly worth the trouble of overcoming all the difficulties and problems connected with maintaining them with the fleet.

65. For protective scouting by air forces we must therefore depend upon the plane, and since these cannot keep the air in-

definitely, the best that can be done is to send them out periodically, say at dawn and at dusk. They can thus cover the day and night circles of the fleet, and can at least insure that no surface craft are within striking distance. The discovery of submarines would be pure luck, and aircraft can run in so rapidly that they cannot guarantee the fleet against their undetected approach. So much for the first duty of aircraft in the protection of the fleet.

66. Now as to their ability to drive off or destroy attacking hostile craft. Against surface and sub-surface craft, bombing planes would be the chief reliance. Against surface craft only, there may be added torpedo planes and fighting planes heavily armed with guns. The employment and tactics of these will be discussed under the next subject. Suffice it to say here that for the adequate protection of the fleet, there must be kept ready for instant flight as many as possible of all these types of planes.

67. Before leaving the subject a word will be said regarding smoke screens in connection with protective scouting, and the possibilities of aircraft in relation to them. It has already been mentioned that aircraft can spot over smoke screens which would be impenetrable to observers on surface craft. So also in observing in connection with protective scouting, aircraft can develop what lies beyond smoke screens laid by the enemy to hide their movements in proximity to the fleet. Information as to the types and number of ships, formations, courses and speeds, and changes of these, can be sent with speed and accuracy to a commander-in-chief blinded by smoke or separated from the hostile forces by an impenetrable pall. Radio telephones would of course be used to transmit this information, as long as they were available.

68. Aircraft dropping smoke bombs can with efficiency and despatch lay smoke screens as designated by the commander-in-chief much more easily and quickly than the same can be done by the comparatively slow movements of surface craft—even destroyers. The fleet could be thus hidden from the approach of hostile craft; or after discovery can be shut out of view while changes in dispositions are made. Hostile air attacks can conceivably be broken up in this manner, by exploding smoke bombs at altitudes which possibly could not be reached by the smoke screens of surface craft.

ATTACK ON ENEMY SURFACE AND SUB-SURFACE CRAFT

69. The fifth use which will be considered is attack on enemy surface and sub-surface craft by air forces. For this, three different weapons are available: the bomb, the torpedo, and the gun. Each of these is best carried by a special type of aeroplane, but they are to a certain extent interchangeable. It has been demonstrated by the recent American experiments off the Virginia Capes that any ship at present in existence can be sunk if enough bombs of adequate size can be placed upon or around her as desired. Bombs up to 2,000 pounds were used and there are at present in existence, bombs of double that weight. The greatest effect from bombs seems to be obtained not by direct hits but by dropping them close alongside the target, where the action is the same as that of a submarine mine.

70. The advocates of the aeroplane are enthusiastic in their predictions of what they will be able to accomplish in future wars, while the adherents of the battleship are by no means hopeless of being able to meet the peril. So much on both sides has been written and made public, including the official report of the Joint Army and Navy Board, upon the experiments, that it is not purposed to discuss here the pros and cons. It is sufficient to know that a new and very promising method of conducting hostilities on the seas has made its appearance, and constitutes a grave menace to the safety of surface fleets. An attempt will be made to indicate briefly the lines which the development of this new mode of attack will take and the means which should be taken to meet it.

71. When a hostile fleet is discovered and its position reported within flying distance of air stations either ashore or afloat, the forces must in the future be considered to be not only in tactical contact, but within range of each other's projectiles. Heretofore it has been of vital importance to open fire at the maximum range at which it is thought that hits can be made with the guns, and the difference of a few minutes has been sufficient to give the side which lands the first salvos a tremendous if not a decided initial advantage. So much was this appreciated that in the naval actions between the British and Germans in the recent war, fire was opened practically simultaneously. Applying the same principles to the use of aircraft it will be of vital importance to land the first bombs upon the enemy's fleet. This will put the same premium

upon increasing the flying radius of bombing planes as was put upon increasing the range of guns, and every effort will be made to get in the first air attack.

72. It is hardly to be supposed that a fleet will approach a hostile coast protected by aircraft, without having command of the air. We shall therefore eliminate this case and confine our attention to that of two fleets approaching striking distance of each other, outside of flying distance from any shore stations. Each will probably strive to deliver the first air attack, just as formerly each tried to land the first gun salvo. But there is a difference in the two cases. The ability to land the first gun salvo depends only upon the range of the guns, and the skill of the personnel in handling them. The ability to land the first bomb depends upon the ability to force home the attack against hostile resistance, much as destroyer or submarine attacks would be made prior to a major action. Means must be provided therefore to break down any resistance encountered. Since the effect of anti-aircraft batteries is practically negligible, the resistance to be reckoned with will be in the air. To overcome this, fighting planes must be sent out in advance to secure temporary and local command of the air. In view of the importance of making the bomb attack as early as possible, the bombing planes will follow close upon the fighting planes, or even accompany them and slip through the hostile fighters while the attention of these is fully engaged.

73. If the opposing air forces are strong and evenly matched, neither side can hope to secure undisputed command of the air for some time, and advantage must be taken of every opportunity to break through. Air attacks must follow each other as frequently and in as great force as the number of planes available and the results of previous engagements in the air permit. The bombing planes must be sent out in squadrons as large as possible, to secure what corresponds in gunnery to volume fire; protected by all available fighting planes. To pursue the analogy, rapidity of fire with guns would have its counterpart in the rapidity with which the squadrons could follow each other out. The destruction of planes before they reached the target would in the same way correspond to the silencing of guns on board shi .

74. The details of the attack and the manner of delivering it must be left to the flight commanders and the individual pilots in the same manner that it is left to flotilla and commanding officers of destroyers. The manner of approaching the target and of releasing the bombs, with allowance for wind, speed, drift, bomb trajectory due to its coefficient of form and specific gravity, etc., is a matter of training and instruction, rather than of tactics, and will not be discussed here.

75. Thus far no assumption has been made as to daylight or darkness, but the foregoing remarks apply chiefly to daylight conditions. Provided the target can be found, darkness offers much greater chances of success to bombing aircraft than daylight. But even if the position of the enemy's fleet was accurately known at dusk, which is all that can reasonably be expected, drastic changes of course and speed in addition to the fact of its being darkened, will make its discovery from aircraft a very difficult matter. Add to this the well-known difficulties of aerial navigation on trips of any distance, enhanced by darkness, as well as the difficulty of keeping other planes of the attacking formation in sight, and some idea can be formed of the obstacles which will be encountered by the attacking planes.

76. If the movements of the enemy fleet have been closely followed after dark by scouting planes or other means, and its position can be predicted within narrow enough limits at the moment the air attack is to develop, much of the bombing plane's difficulty disappears. With good weather conditions—that is a clear night, preferably moonlight with a wind whose force and direction can be counted on to hold—planes should be able to locate a hostile fleet sufficiently closely to disclose it by means of parachute flares.

77. Prior to the armistice, flares of 2,000 candle-power supported by eighteen-foot parachutes were constructed which burned up to eleven minutes. Since then flares have been developed of 200,000 candle-power capable of illuminating an area five miles in diameter and of making it as clear as day. The construction of flares of 1,000,000 candle-power is planned. The parachute screens all space above it and reflects the light downward so that the planes can operate unseen in the gloom above while everything on the surface of the sea is clearly disclosed.

78. A night attack upon a fleet would be conducted by sending out in advance a number of planes to drop parachute bombs over and around the hostile ships. These would be closely followed by the bombing planes, which, having picked their targets by the light of the flares, could attack them either before or immediately after the flares became extinguished. It is thought that the bombing planes would be in no very great danger even if they attacked in the light of the flares. Since the whole attack would be in the nature of a surprise, the anti-aircraft batteries would be of little use and the protecting planes would not have time to take the air. If they attacked after the flares had expired, they could fly down in the darkness as low as they desired so as to be certain that each bomb reached its mark.

79. The defense against such an attack would at best be haphazard on account of the difficulty of finding planes in the vast space of darkness, by the uncertain aid of searchlights or star shells fired at random. The best, if not the only defense against such an attack would be the putting out of action of the enemy's plane carriers from which the attack would emanate, before darkness set in.

TYPES OF BOMBS

80. Various types and sizes of bombs are available for use from aircraft. First, demolition bombs weighing from 25 to 4,000 pounds, loaded with high explosive comprising more than fifty per cent of their total weight. These are primarily for the destruction of material, but incidentally destroy personnel as well. Second, numerous kinds of asphyxiating, poisonous, and tear gas bombs, designed for exerting different effects. These are for use solely against the personnel, some of which kill outright, while others produce temporary blindness, asphyxiation, etc. It is expected that the fumes of these bombs will enter the ventilating ducts of the ship and permanently or temporarily disable all the personnel in artificially ventilated compartments, as well as those on open decks within considerable radius of the explosion. These bombs may thus do more to put a ship out of action than the direct but more or less localized destruction caused by demolition bombs.

81. Finally, there are smoke bombs designed either to shroud the ship in a pall from which nothing can be seen, or as a smoke

screen through which air and surface torpedo craft can attack. The effect of all these bombs has been so well demonstrated in the recent American experiments upon the ex-German warships and the *Alabama*, so completely reported upon, and so thoroughly discussed, that nothing further can be added here; and those interested are referred to the official reports upon the tests.

TORPEDOES IN AEROPLANES

82. We shall pass on then to the consideration of the next weapon available to the aircraft—the automobile torpedo. At first sight this appears to be a formidable weapon, but both the weapon itself and its mode of handling from aircraft present certain difficulties. First as to the weapon itself. To begin with, a large proportion of the weight of a torpedo is taken up by the air flask, machinery, tail, etc. This is of no destructive effect. Hence the useful load as regards destructive power of the torpedo is small compared to the useful load of the bomb. The weight of the explosive is only about twenty per cent of the total weight of the torpedo; whereas in the case of the bomb the weight of the explosive is fifty per cent or more of its total weight. Comparing a bomb and a torpedo of the same weight, the former has two and one half times as much explosive as the latter. This is of course partly made up for by the fact that in the case of the torpedo the explosion, if it occurs at all, is in direct contact with the hull of the ship; whereas with the bomb, it is at a distance corresponding to the skill with which it is dropped.

83. The mine effect is thought to be the greatest which can be produced by a bomb. A direct hit of a bomb may do terrific local damage, but would probably not endanger the stability of the ship to as great an extent as a hit of a torpedo carrying the same weight of explosive. To secure the same effect a bomb must be dropped exactly alongside. But two and one half times as much explosive can be carried in the form of bombs as torpedoes. If this is carried in two bombs, there are double the chances of placing one so as to do as much damage as the torpedo. At present no attempt can be made at figuring out the relative chances of making hits with bombs or torpedoes.

84. In the next place the structural defense against underwater explosion is being vastly improved as a result of the

recent war, and the future dreadnaught may be less vulnerable to under-water attack than attack from the air. It is however to be expected that steps will be taken to protect ships against attacks from the air as well, and it is impossible to say which will be the more effective until it is known what protection will be embodied in the future ships against each. At present it would seem that both weapons have possibilities warranting development, and skill in the use of each should be striven for.

85. Now as to the mode of handling torpedoes from aircraft. The latter must come down to within twenty feet of the water in order to successfully launch a torpedo. Too great a height or speed of plane will result in damage to or derangement of the torpedo which will prevent its running. Now, when a plane comes down to fire a torpedo in this manner, it deprives itself for the time being of one of its greatest assets—the ability to maneuver in the third dimension. It reduces itself temporarily to practically the limitations of a surface craft, except as to speed. It becomes exposed to the same danger of being picked up, and to the rapid fire of secondary batteries, in the same manner as surface torpedo craft; but the plane is much more vulnerable, not only to direct hits by the fragmentation of shrapnel, but to splashes, which would wreck it by tearing its wings, rudders, and stabilizers to pieces. An effective splash barrage laid just ahead of attacking torpedo planes would probably prevent their passage, even if light metal were substituted for fabric in their construction.

86. Another disadvantage of the torpedo is its relatively slow speed. The plane can reach the target quicker than the torpedo which it launches. One naturally asks then, why not have the plane continue its flight and attack the ship with bombs from a relatively safe altitude, instead of using torpedoes at all, from a dangerously low level? The possibility suggests itself of the development of an aerial torpedo which would be more accurate than the bomb, and have none of the limitations of the water torpedo.

87. However, let us consider the tactics of the torpedo plane and its weapon as they at present exist. Having reduced itself, except in the matter of speed, to the status of the surface torpedo craft, it must attack in much the same way as the latter. Its

greatest chance of success would be at night, or through smoke screens. The attack should be delivered in divisions or squadrons of planes from the most advantageous angles for making hits, provided the force and direction of the wind are not governing factors in the handling of the planes themselves and the laying of the smoke screens. The screen can probably be best laid by a squadron of aeroplanes carrying smoke bombs, and co-operation between these and the torpedo planes must be worked out in advance to prevent collisions, interference, etc., as well as the method of retirement of both types. The manner of delivering the attack must be left to the flight commanders and pilots just as in the bomb attack. Incidentally it may be remarked that much difficulty must be expected in estimating from aircraft at night the course, speed, and range of the target vessel.

GUNS ON AIRCRAFT

88. The third weapon available for attack on ships is the gun. During the Great War only machine guns were used, each fighting plane carrying two: one mounted on the upper wing, and one in front of the pilot. The Lewis gun was the type used practically exclusively by the Allies on the upper wings; and, after synchronizing gear was invented for firing through the propeller, the Vickers was standardized for this kind of fire and used to the exclusion of all others. The latest practice is to use both of these types of guns in pairs, in twin mounts, in order to double the volume of fire.

89. More recently one and three pounder automatic cannon have been mounted, and a three-inch semi-automatic for use on aircraft is being constructed. These guns will greatly increase the offensive power of aircraft against the fire control tops, bridges, upper works, and exposed personnel of ships. They will be particularly effective against destroyers, whose personnel is absolutely exposed, whose light decks and side plating could be completely riddled, and whose anti-aircraft defense is necessarily feeble.

90. For use solely against personnel—landing forces in open boats or on beaches, troops in trenches or on the march, and columns of troops and transport on congested roads—the latest development is the Larsen all-metal plane. It has a speed of

140 miles an hour and carries thirty machine guns of 45-cal. These are mounted along the bottom of the fuselage so as to fire directly down. Each gun fires at the rate of 1,500 shots per minute, or 45,000 shots per minute, total rate. The effect of such a blast upon the open decks of lightly protected vessels can be imagined; but their principal use is against troops, and they would be very valuable in repelling a hostile landing.

ESCORT

91. The fifth use of aircraft is for the escort of surface ships. This includes both the escort of fighting ships and of convoys, and is primarily for defense against submarines, although it would also be effective against hostile aircraft. In the future, every battle fleet and scouting detachment will, where conditions require it, doubtless have its screening force of aircraft similar to its screening force of destroyers. But the air escort will be particularly valuable for convoys through submarine waters; and it was for this purpose that it was used with great success in the recent war, along the coast of England, in the Channel, and on the coast of France.

92. When escorted by aircraft there were almost no cases of attack on convoys by submarines, and hardly a sinking while the aircraft were in the air ready for duty. German submarines always submerged when a plane was discovered. The tactics of aircraft were to bomb the submarine if possible, but in any case to drive it under at such a distance from the convoy that with its low submerged speed it could not get into position to attack. If the submarine was driven under ahead of the formation, the aircraft could by signal divert the convoy and guide it clear of the danger. It could also lead escorting surface vessels to the attack when it could not itself damage the submarine, occupying as it does the most advantageous position for spotting submarines awash or just submerged, and for noting oil slicks, wakes, etc.

93. Dirigibles are especially suitable for convoy work if there is no danger of contact with the hostile aeroplanes, as they can regulate their speed more easily to that of the convoy by stopping, hovering, etc., there is less strain on the personnel, and they can accompany the convoy much further than planes. But for the actual attack on submarines, planes are superior on account of

their rapid maneuvering qualities. Escorting aircraft must always keep their mission in mind—the protecton of the convoy. On no account must they leave their station and be lured away in chase of some real or imaginary enemy at such a distance that he could not possibly harm the convoy. The position of the suspected enemy can be reported and other craft sent to deal with him, but not the units of the escort. There is too much chance of another submarine, perhaps co-operating with the distant decoy, coming in during the absence of the escort and playing havoc with the convoy.

94. Escort is closely allied with mine and submarine search in general, both of which can be ably performed by aircraft if the water is sufficiently clear and the character of the bottom is favorable. The high position of the observer from aircraft gives him a great advantage over one on a surface ship, in penetrating beneath the surface of the sea. Some success was had in locating mine fields and submerged submarines in the Great War, even under the disadvantageous conditions of the North Sea.

DISPATCH CARRYING

95. The remaining uses of aircraft as listed at the beginning of this paper, are of a minor character. In the present day of rapid and accurate communication, dispatch carrying does not have the importance which it did before the employment of radio. However, there can conceivably arise cases when the rapid transmittal of secret maps and plans which from their nature cannot be sent by radio or telegraph may be of the utmost importance. In such cases the aircraft offers the most convenient mode of transportation. The type of craft used for this purpose is of no importance except as limited by the urgency of the matter, the distance involved, and the conditions to be met en route. The selection of the best type from those available will of course be made. Since the capabilities of different types have been touched upon in considering the uses of aircraft already discussed, there is no necessity for trying to determine here the best machine to use in every possible contingency.

TRANSPORTATION

96. The above remarks apply in great part to the transportation of personnel and of small vitally needed articles of ma-

terial. It may be necessary to get a commanding general rapidly to the front, or to an urgent conference at a specific time; or to transfer a naval commander-in-chief from one ship of his command to another at considerable distance. It may be necessary to send vitally needed chemicals or important spare parts to ships or organizations at the front. The aircraft again furnishes the most serviceable means.

EVACUATION OF THE WOUNDED

97. The employment of aircraft to transport the seriously wounded has already been tried and planes have been fitted to carry them. But the capacity of planes for this purpose is necessarily so limited that this means of transporting the wounded cannot be expected to cope in any way with the conditions of modern battle. Furthermore it could only be used from localities suitable for landing and not under fire. It could be used to transfer a few men from isolated positions where ordinary means are not available, to base hospitals; provided a sufficient number of planes can land there with reasonable assurance of success. This use is more applicable to times of peace or inactivity, for the transport of individuals from outlying districts to base hospitals for urgent operations, than it is to the conditions of battle. Dirigibles could possibly be fitted as hospital ships, but it is doubtful if the results would warrant the outlay. Military exigencies would not at present countenance the diversion to that use of such important aerial units. When dirigibles become as numerous as ships, we may possibly see such hospital ships of the air.

CONTROL OF OPERATIONS FROM THE AIR

98. As to the control of operations from the air, it is not believed that this has been tried upon any large scale. It is mentioned as a possible suggestion for the future. A birdseye view of a situation, particularly during an approach or an attack on shore, might be of more value to a naval or military commander-in-chief than all the mass of conflicting information sent in by other means. Of course the risks involved in a commander-in-chief leaving his flagship or headquarters must be fully weighed and he must be in direct and instant communication therewith at every moment of his absence. His flight should in general not carry him too far or absent him too long. Control of opera-

tions from the air should be primarily valuable in making dispositions *prior* to the opening of fire, and it would seem that it should terminate before that event; as otherwise there is too much risk of the commander-in-chief being lost or permanently separated from his command. This applies more to conditions at sea than on shore.

99. It might be perfectly practicable for superior officers of land forces, other than the commander-in-chief, such as army or corps commanders, to control operations along their sector of the front from a properly safeguarded dirigible operating some distance behind the lines. Their ability to visit any part of the sector and observe details of troop movements and concentrations far back into the enemy's zone, with their consequent ability to order instant countermoves or to take advantage of obvious weakness, which if reported to headquarters in the usual manner would be so delayed as to lose the opportunity for decisive strokes, should go far to outweigh any attendant risks.

100. At sea conditions are very different. There is no fixed battle front as on land. Kaleidoscopic changes in tactical situations and groupings of forces occur. Hostile forces can make their appearance from any direction. Moreover, sudden changes in weather conditions may reduce or destroy visibility. The flagship does not remain in one place as does headquarters ashore. It would therefore appear extremely unwise, in the present stage of development of aircraft, for a naval commander-in-chief to thus separate himself from his fighting forces during an engagement.

101. In the future, development may so increase the stability, defensibility, and importance of aircraft, that the commander-in-chief can embark with as much safety in a powerful unit of the air force as in one of the sea fleet. In fact air forces may become so increasingly important in future wars as to overshadow the importance of the surface fleet. It is conceivable that the major action of the future may possibly be fought in the air, with the surface craft as the auxiliary force. The director of operations should be with the main force—that is in such case in the air. It will be, from the present outlook, a far cry to such a situation; but this should not prevent due consideration of the advantages of directing operations from a swift and reliable unit of the air force.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

AN ADMINISTRATIVE FLAGSHIP FOR THE UNITED STATES FLEET

By Captain J. K. Taussig, U. S. Navy

While little has appeared in print concerning an administrative flagship for the United States fleet, there has been much oral discussion of the subject. As captain of the only ship which has served in this capacity, the writer has taken an active part in many of these discussions. From them an impression was gained that most officers did not have a full appreciation of the reasons for the adoption of this innovation. There was, therefore, much opposition to the idea within the service. This opposition, added to outside influences, undoubtedly had much to do with the abandonment of the plan before it had been given a fair trial.

Be that as it may, the aforementioned discussions have left the conviction that an administrative flagship is the inevitable outcome of progress in organization, administration, and command; that its addition to the fleet was sound in principle; and that its final abandonment would be a decided step backwards.

It is not surprising that there should be differences of service opinion as to the propriety, necessity, or desirability of having an administrative flagship. Such differences have always been manifest whenever a new departure is undertaken. But in this case, when arguments are advanced against the plan, they are usually expressed in general terms which are not difficult of refutation. The opposition also have reasons which are not expressed, but which show intuitively to be in the minds of those who have difficulty in putting their thoughts into words.

Let us look briefly into some of the reasons for the opposition to the administrative flagship plan.

First, we have the well known conservatism with which a majority of naval officers are imbued. The President of the Naval War College in an address[1] to the last graduating class pointed out how this conservatism was common to naval and military officers as a class, and how, on account of it, advancement along different lines often had been retarded. From those who feel this conservatism in regard to the administrative flagship, the argument is advanced that we have always got along without one, so why make a change? Here the argument ends. They are satisfied to continue to "muddle through."

Then there is our old friend "tradition." In some respects our adherence to tradition has had a salutary effect on the morale and efficiency of the navy. This is because many of our traditions are good. But all traditions are not good, and those that are not, should, of course, be relegated to oblivion. If the world in general had stuck to all its traditions there would have been little advancement. Improvement has come by discriminating between the good and the bad, and casting aside the bad. Here we have the tradition that a naval commander must always be in the front line. It used to be tradition for an army commander always to be in the front line, and always to lead his troops in battle. As armies grew larger, this tradition had to give way to more sensible practice. The commander of an army now takes a position from which he can best handle the situation, and this position is *not* in the front line. It is what is known as "general headquarters," and may be anywhere *not too near* the fighting front. Those who argue against the administrative flagship on account of the front line tradition are imbued with the tactical considerations rather than the strategical and the administrative. The question as to whether or not the commander-in-chief should be in the front battle line during an engagement is not involved in the pros and cons concerning an administrative flagship. The value of such a ship depends on whether or not, in the preparing and training of a fleet for battle, and in the long strategic campaign which must of necessity precede a fleet battle (should there eventually be one), the commander-in-chief is in a better position to develop a more efficient fleet and to carry on a more logical campaign, than if he were always tied down to a slow moving battleship.

[1] "Military Conservatism," by Rear Admiral Sims, published in NAVAL INSTITUTE PROCEEDINGS for March, 1922.

The third reason for opposition is because an administrative ship is not a fighting unit. This can not be a valid reason for denying the employment of such a ship, especially when account is taken of the facts that, in time of war, the auxiliaries far outnumber the actual fighting ships so that the addition of a single non-combatant ship does not become significant; and actual fighting is only the culmination of certain things that go before. Actual fighting may or may not take place. But the things that precede the expected fighting must of necessity occur.

The conduct of these operations has a direct bearing on the ability of the battle fleet to fight a successful engagement. One additional vessel of a non-combatant type justifies itself a thousand times if *in any way* it aids the commander-in-chief in the organization and administration of the fleet, and in the needed communications with the hundreds of widely scattered vessels of his command.

Other expressed reasons for opposition to the administrative flagship are economic and political. The two are usually linked together, as the demand for economy, where it interferes with efficiency, is political in nature. It is generally applied only in such cases where local interests do not suffer thereby. It is argued that especially at this time when an economic wave is sweeping the country there should be no move towards irritating Congress by the addition of a vessel to the fleet, the use for which they, as a body, do not appreciate.

Nothing is gained in the long run by failing to fight for needed naval improvements. And if naval officers do not fight for them, nobody else will. Many good military and naval plans which would undoubtedly have led to increased efficiency and ultimate economy have failed to pull through because of purely political opposition. And when the Congress turns down a department proposition for what they call economic reasons, it is usually because of a false conception of what military or naval economy really is. With them it is not a case of "a stitch in time saves nine." On the other hand it is a viewpoint based on the false assumption that it is economy to save a dollar today even if by reason of doing so ten dollars must be spent tomorrow. The history of naval legislation shows that Congress has not the habit of looking into the future. The Navy Department through its responsible

officers must assume this burden and do what is possible. Therefore if in its wisdom the Navy Department concludes, after a careful estimate of the situation based on the lessons of the World War and a look into the probable future situation, that an administrative flagship is an addition that will increase the efficiency of the fleet, the sooner action is taken the better, and, although it may receive some hard knocks, the sooner will it be a permanent institution.

The foregoing is a brief summary of the reasons heard expressed against the adoption of an administrative flagship. Undoubtedly there are officers who can advance other reasons against the plan. However, no others have been heard in any discussion in which the writer has taken part.

When one examines into the reasons for the adoption of the administrative flagship there are many arguments in its favor.

In order that a fleet can operate successfully in war it must be prepared in times of peace. This peace preparation consists of: (1) The providing of personnel and ships by the Congress; (2) The co-ordination of the fleet so that the various forces will be properly balanced; (3) the training of the fleet so that when the elements are co-ordinated they will act together for the common end; that is, co-operation; (4) the handling of the immense amount of detailed work that is essential to bring about co-ordination and co-operation; that is, administration; (5) the making of war plans.

The Congress has provided ships and the personnel for partially manning these vessels. Whether or not this personnel is adequate is beside the issue here. However, having these ships and a definite number of officers and men, the Navy Department is charged with the organization of the fleet. The Department then, in turn, appoints a commander-in-chief. This officer is responsible for the training and administering of the fleet together with the preparation of certain plans for the employment of the fleet in peace and in war.

It has been customary to have a peace organization and a war organization. This, of course, is fundamentally wrong. It was so demonstrated by the upheaval in the organization of our fleet which took place when we became a belligerent. The peace organization then consisted of an active fleet and a reserve fleet, the latter being a part of the former. The fleet as a whole was

composed of a battleship force, cruiser force, destroyer force, train, etc. The commander-in-chief was always on a battleship.

After the war the fleet was divided. This occurred contrary to the recognized military and naval teaching that concentration is the first great principle of strategy and tactics. Each of the two so-called fleets were divided in the same manner as was the united active fleet prior to the war.

To one who has studied strategy and tactics and who has learned the lessons of the Great War, it is evident that the peace-time subdivisions of our fleet or fleets are not the best. Instead of having all the ships of the same class in a force or group, each subdivision should consist of a combination of ships of different classes in accordance with the duty to be performed. These subdivisions are commonly known as "task groups." For proper organization and training each task group requires its own commander, through whom the commander-in-chief should control.

Such an organization as this has been adopted by the department for use when the Atlantic and Pacific fleets are combined for joint operations, a combination which undoubtedly will become permanent as soon as the political situation admits. This organization is published in Table II of the *Navy Directory* of January 1, 1922. It is based on a logical distribution of the vessels of the fleet in accordance with tasks that would be imposed in case of war. The main task groups are classed as forces as follows:

(1) Administrative flagship (*Columbia*).
Tactical flagship *(Maryland);* also a unit of the battle force.

(2) The BATTLE FORCE, composed of:
One battle squadron.
Six destroyer squadrons.
Air squadron.
Submarine squadron.

(3) The BASE FORCE, composed of:
Old battleships.
Old cruisers.
Mine squadron.
Train.

(4) The SCOUTING FORCE, composed of:
One battleship division.
Nine destroyer squadrons.
Air squadron.
Submarine squadron.

(5) The CONTROL FORCE, composed of:
Old battleships.
Old cruisers.
Mine squadron.
Destroyer squadron.

In this organization the fleet is always ready for immediate expansion and operation in case of war. The commander-in-chief is on a separate vessel called the administrative flagship, which, at this time, happened to be the *Columbia,* formerly the *Great Northern.*

Why, in this carefully thought-out organization of the United States fleet, should the commander-in-chief be on a vessel independent of all the forces?

The commander-in-chief of a large fleet, the units of which a great part of the time will be widely scattered geographically, must, for administrative purposes, be free to go wherever and whenever he pleases. He should not be tied down to the battle force, scout force, or control force, any more than the commander-in-chief of an army should be permanently attached to the infantry, cavalry, artillery, or any other subdivision. When we look at it in a broad sense it seems strange that, with the development of our fleet, we have so far lagged behind in organization and administration as to insist on the commander-in-chief not only being tied down to a battleship, but also often in immediate command of the battleships composing the force.

This practice has not been to the advantage of the navy. It has had much to do with the lack of balance in our fleet today. The necessity for and the importance of the fighting auxiliaries, especially the cruisers, have not usually been appreciated by the officer in chief command afloat owing to his intimate connection with the battleships. The submarine alone is responsible for the increase in destroyers, which vessels were numerically inadequate until the war forced them otherwise. Our commanders-in-chief

have been so much more intimately connected with the battleships, it is natural that their efforts for efficiency have been devoted mostly to this class of vessel. Until recently there has not been sufficient concentration of effort to obtain the necessary cruisers and other fighting auxiliaries that a balanced fleet requires. Consequently the limitation of armament agreement finds us without any battle cruisers, very few light cruisers, and no destroyer leaders. We are forever precluded from having any battle cruisers. It will be many a day before Congress will be in a mood to provide light cruisers and destroyer leaders.

It is held that this would not have been the case had our commanders-in-chief not always been battleship men, tied to battleships and nothing else.

Being attached to one of the subdivisions of a fleet, be it battleships, cruisers, or any other class of ships, is not conducive to the proper administration of the fleet as a whole; does not permit the commander-in-chief wide enough latitude in conducting a strategic campaign; may be of considerable embarrassment to him in a fleet action; and, owing to the perversity of human nature, narrows his viewpoint.

It is believed that if prior to and during the battle of Jutland, the British commander-in-chief had not been physically attached to the battleships, but could have been on a separate ship—fast enough to take station where he pleased, and with plenty of room for the staff necessary to control so many units—the British forces would have been better co-ordinated, and consequently their co-operation much more effective when the long looked for day arrived.

When this country became a belligerent in the Great War the commander-in-chief of the United States Fleet was so closely identified with the battleships—he and his staff being housed on one—that, in so far as actual command was concerned he never did control the forces operating in the vicinity of the enemy. Excepting for an inspection trip, which was not made on a man-of-war, he remained physically associated with the large portion of battleships which kept far from the scene of conflict. On account of this we had the painful experience of witnessing our commander-in-chief with his highly trained staff unable to perform the functions for which intended. Instead, the actual war

operations were placed in the hands of a subordinate, who, not being physically attached to a battleship, was free to go abroad. Here, owing to a lack of foresightedness in our organization, he had to recruit, organize, and train a staff after the beginning of war, and while actually conducting operations against the enemy.

There are a number of disadvantages in having the commander-in-chief on a battleship or any other purely fighting ship. In the first place the living spaces on a battleship are crowded, even when there is no flag officer. When such a vessel becomes the flagship of the commander-in-chief the conditions become very unsatisfactory owing to the size of his staff. And the commander-in-chief of the United States fleet should, in order properly to administer, command, and plan, have a staff of not less than twenty officers. No fighting ship can accommodate this personnel without undue crowding. Fighting ships are not built that way.

The battleships in order to be effective should train and operate together. Their efficiency as a fighting force depends on their concentration and effective co-operation. Some parts of the fleet may be, and the bases will be, in widely scattered localities. The battleship is expensive to operate. Its separation from other battleships weakens the fleet as a whole. It is illogical to place the commander-in-chief on a vessel that is the most costly to move from place to place; that interferes with proper training of personnel; and which, by detachment, diminishes the fighting strength of the fleet.

The commander-in-chief should be so situated that he will not be forced through economic or other reasons to refrain from visiting any part of his fleet and to go to any base in order that he can inspect and make effective plans for the future. We in the navy must keep pace with developments that, for efficiency and future safety, demand the breaking away from traditions which progress has shown to be faulty. We, like the army, must, for the proper handling of a large force, establish a general headquarters which can be moved to the best situation at the discretion of the commander-in-chief. In order to do this the general headquarters must be entirely independent of the subdivisions that compose the fleet as a whole. The fleet general headquarters must be a ship. It is what, for want of a better name, the Department calls an administrative flagship.

Officers have been heard to say that the commander-in-chief has too large a staff. This is because the functions of such a staff are not understood. Many do not see beyond the tactical relation between the commander-in-chief and his fleet. They fail to appreciate that tactical distributions and movements are only the culminations of organization, training, strategy, logistics, planning, and administration. They overlook the importance of communications. A staff of twenty officers to assist the commander-in-chief of a force as large as our United States Fleet, is not too large.

The separate flagship for the commander-in-chief is desirable for the development and training of the officer personnel. This is one of the most important functions of the fleet in peace times. It is not given the careful consideration that is its due. We spend hundreds of thousands of dollars in the training of individual ships for target practice. Even when there is no cloud on the horizon we go on and on with the training of the enlisted personnel, nearly all of whom are transients, and the most of whom will not be in active service should a war come. This training of the enlisted personnel is necessary, and is as it should be. But when we consider the large sums spent for this purpose in contrast to the very small sum allowed for the training of the officer personnel, it does seem that a more useful distribution of funds might be made. Only this year the concentration of the fleet with the accompanying maneuvers had to be abandoned for the lack of funds. This maneuver period was to have been one of real training for the officer personnel. Such joint-maneuvers are more important than target practice by individual ships. This is because the officers are the only really permanent part of the navy. They come and they stay. If there is a war within a generation the larger part of them will be in active service. Therefore their training is most important. The efficiency of the transient enlisted personnel depends primarily on the efficiency of the permanent officer personnel.

While this may seem to be a digression from the subject at hand, it is in fact intimately connected with the administrative flagship. Two of the functions connected with the training of the officer personnel are the tactical game board and the chart maneuver. These tactical games and chart maneuvers to be

properly conducted require space and facilities beyond the capacity of a battleship, or any other purely fighting ship. They require from one to two weeks for each game or maneuver. Therefore, if attempted on a battleship they greatly interfere with the routine and training of the crew. In a properly appointed administrative flagship all these difficulties are overcome. The commander-in-chief has at his disposal the personnel, the space, the time, and the facilities for the studying and making of plans, and for trying them out on the game board and in chart maneuvers. This is an asset for the commander-in-chief, which, if the administrative flagship had no other attributes, fully justifies the Department in its adoption.

And last but not least is the question of communications. We are learning to appreciate the importance of this, especially with regard to the uses of radio telegraphy. The possibilities in this direction are so great, and the advantages to a fleet which has grasped the opportunities are so vital, no means should be lost in making them effective. In order properly to do this, there are required many instruments, much space, considerable personnel, and extensive aerials. There is not room on a battleship for any of these unless our communications are limited to the peculiarities of such a ship. And such limitation would be inexcusable. A ship on which there is ample room for the instruments and personnel without interfering with its legitimate work; a ship on which aerials are capable of permitting the simultaneous working on from twelve to twenty wave lengths without interfering with the arcs of train of the guns; a ship in which the commander-in-chief could, during an extensive strategic campaign, take a central position and efficiently communicate at one and the same time with all of his forces; such a ship in case of war would be worth its weight in gold. And such a ship is also invaluable in peace times on account of the part it can take in the development of fleet communications.

To summarize: A logical organization of the United States Fleet requires for the commander-in-chief a ship independent of any and all subdivisions of the fleet. This is necessary in order that:

1. He and his staff can be properly housed without interfering with the fighting efficiency of any ship.

2. He can take a broad view of the entire situation instead of having his horizon partly limited by his physical attachment to any one subdivision.

3. He can go when and where he pleases without interfering with the training of any unit of the fleet, or weakening its fighting strength. Such freedom of movement is necessary in order that he can inspect any part of the fleet, and visit any of the fleet bases with the view to obtaining of first hand information to assist in making plans.

4. He can have adequate facilities for planning, with sufficient space for carrying on tactical games and strategical chart maneuvers.

5. He can develop and carry on communications in keeping with the demands of administration, and to insure efficient co-ordination and co-operation within the fleet, and from fleet to shore.

Such a ship must have certain characteristics, some of which are:

1. It must be of sufficient size to:
   (a) Have adequate quarters for the admiral and his staff—administrative, tactical, and personal.
   (b) Have space for administrative offices, operation office, intelligence office, game board room, conference room, record room, etc.
   (c) Have sufficient space for radio rooms and aerials; chart room and plotting room.
2. It must be seaworthy and steady.
3. It must have a sustained speed greater than that of the battle force.
4. It must have a large steaming radius.

It is manifest that no battleship nor any other fighting ship possesses the above characteristics. Nor does any merchant ship possess all of them. In order to obtain a perfect general headquarters ship it will be necessary to build one. There is no danger of that happening in the near future. Such a ship would be worth more to the navy and the nation than any single unit which the limitation of armament agreement permits us to build. However, the day is coming when, if we do not take the

lead in this matter, we will have to follow in the footsteps of some other navy, a condition which has frequently happened with new advanced ideas originating in our own service.

The Navy Department in order to make the combined fleet organization effective, appreciated the necessity for an administrative flagship. It was realized that no fighting ship was suitable, and to convert a fighting ship would cost more than was at the Department's disposal. In the search for a suitable vessel the *Great Northern* was selected. The President signed an executive order which transferred that ship from the army to the navy.

There is no question but that the *Great Northern* came nearer to the ideal for an administrative flagship than any other vessel under the American flag. At a comparative small cost she was converted for this purpose and renamed the *Columbia*.

The *Columbia* is not a "huge" vessel as has often been represented in the press. In fact, as merchant ships go, she is of quite moderate size.

Her chief characteristics are: length, 525 feet; beam, 63 feet; mean draft as flagship, 25 feet; displacement at this draft, about 12,500 tons.

She has triple screw Parsons' turbines capable of maintaining a sustained speed of from 21 to 23 knots according to draft.

Her fuel capacity is 3,000 tons of oil which gives a steaming radius of over 9,000 miles at 15 knots. She is very economical in port, using less than six tons a day. It would have been an easy matter to increase the fuel capacity by the conversion of one or more hold spaces into tanks. This probably would have been done as soon as money became available.

The battery had not been installed on account of lack of funds. It was to consist of four 6″ 53-caliber guns and four 3″ anti-aircraft guns. A saluting battery of four three-pounders was located forward on the boat deck.

The boat equipment consisted of:

1 50-foot motor barge for the commander-in-chief.
1 40-foot motor barge for the chief of staff.
2 35-foot motor boats for staff use.
2 35-foot motor boats for ship use.
2 40-foot motor sailers.
2 36-foot motor sailers.
2 28-foot whale boats.

The radio equipment was as powerful as any afloat. In so far as known, it was more complete, with facilities for listening in on more tunes, than any previously installed on any vessel in the world. While all aerials had not been completed, a glance at the photograph (frontispiece) will show their extent, and the insulations inserted throughout the standing rigging.

By further reference to the photograph it will be seen that there is a main deck extending the full length of the ship. This is known as "A" deck. Above it is the boat deck, and below it, with air-ports, the "B" and "C" decks. Although the next lower deck, designated as "D", is above the water line, the air-ports with which it was fitted throughout its length were sealed up during the war and had not been reopened.

On the boat deck were carried the two 36-foot motor sailers and four 35-foot motor boats. They were hoisted in on davits. The two barges and two larger motor sailers were carried aft on "A" deck. They were hoisted in by a large boom which is shown in its topped-up position in the photograph.

Over the bridge and chart house was the plotting room with signal platform on top. Under the bridge and chart house were the captain's quarters. The galley for the admiral's, captain's and staff messes was in the deck house abaft the after smoke stack.

Opening on to the enclosed part of the promenade on "A" deck was the large conference room adjoining the admiral's quarters, which consisted of living room, stateroom and bath, and spare stateroom and bath. Abaft this was the chief-of-staff's cabin with staterooms and baths for the chief-of-staff and assistant chief-of-staff, and one spare stateroom and bath.

Opening on to the open part of the promenade were staff officers' staterooms, and, in the after-most part, the large game board room with a 30-foot skylight. This room was also used as the staff officers' mess room.

On the "B" deck (upper row of air-ports) was the auxiliary radio room forward of the mast. On the starboard side were the wardroom officers' staterooms, wardroom, junior officers' mess room, junior officers' staterooms, and all the ship's offices. On the port side were staff officers' staterooms, and the staff offices comprising intelligence office, operation room, fleet pay-

master's office, administrative staff officers' office, communication office, flag secretary's office, record and file room. Abaft the mainmast in a large space was the main radio room, and abaft this, the sick bay.

The warrant officers' mess room and staterooms, the large laundry, and printing rooms, were on "C" deck (lower row of air-ports). Practically the entire remainder of this deck was crew space—large airy compartments on both sides extending half the length of the ship. An important feature and one of real value was that the ports of "C" deck are sufficiently high above the water line to permit of their being kept open at sea at all times excepting during bad weather.

It is unfortunate that, after spending considerable time and money fitting up the best ship to be had for the use of an administrative flagship, commercial and political interests forced the navy to give it up. This the more so as there is not another merchant ship flying the United States flag that has the combination of size, habitability and sea-worthiness, together with the necessary speed, to warrant its conversion for this purpose.

A battleship has been shown to be unsuited for many reasons. The new scout cruisers are impracticable of conversion. In the first place they are much needed for the duty for which they are built. In the second place they have not sufficient berthing and living spaces for their regularly allotted complement of officers and men. It would seem that in the absence of a better ship, the conversion of one of the old armored cruisers is the most feasible alternative. And if it is feasible, it should be done. These cruisers are of sufficient size and have fair speed. By the removal of some of the unnecessary battery, and by making not very extensive alterations in the living and other compartments, one of these vessels would be of sufficient value to the organization to warrant its assignment to this special duty. Then, when it proves its value, as it undoubtedly will if given the opportunity, further alterations such as converting from coal to oil burning, can be made as soon as funds are available.

It is to be hoped that the Department will see its way clear to provide another administrative flagship in order that the excellent organization developed for the combined United States Fleet will be thoroughly effective.

Brains do not belong in the body; they belong in the head. Therefore let us provide a head, in the form of an administrative flagship, to carry the brains which are to control the United States Fleet.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

REAR ADMIRAL PEARY, U. S. N., SCIENTIST AND ARCTIC EXPLORER

By Lieutenant Commander Fitzhugh Green, U. S. Navy

Lieutenant Commander Fitzhugh Green is well qualified to write a sketch of Admiral Peary's life. Lieutenant Commander Green has always been a hunting and camping enthusiast. Study of arctic literature and a close friendship with Admiral Peary eventually led him to join the Crocker Land Expedition. He spent over three years with the Smith Sound Eskimos in North Greenland and Ellsemere Land. In 1914, Green and Macmillan established a new record to the Northwest on the Polar Sea. The author of this article has enjoyed the friendship of Amundsen, Shackleton, Stefansson, Evans, Rasmussen, and others in our generation who have with untiring zeal helped blaze the long white trail to the Ends of the Earth.

Editor.

Robert E. Peary was born in Cresson, Pa., May 6, 1856. He passed his boyhood in Maine and graduated from Bowdoin College in 1877. He entered the Coast and Geodetic Survey from which he joined the navy as a civil engineer in 1881. By 1885, though only a lieutenant, he was engineer-in-chief of the Nicaraguan survey. He invented a new type of lock-gates for the proposed canal and otherwise distinguished himself from the common run of youthful pioneers.

His Danish friend Maigaard literally broke the ice for the second period of Peary's life. He persuaded the young officer to accompany him to Disco Bay, Greenland, for an ice-cap reconnaissance in 1886. Instantly and deeply was Peary bitten by the exploring bug. And nothing could have demonstrated his personality and temperament better than that he threw all precedent and centuries of experience to the winds: he determined to strike out on a new unbeaten path to the Pole.

Since Hakluyt's day men had tried to penetrate the Polar regions by water routes. There were three main gateways:

1. North around Scandinavia past Spitzbergen.

2. Through Baffin Bay up the Greenland coast.
3. By Alaska into Behring Sea.

Early Europeans used the first route because it enabled them to cling to their continent. As the second, by Greenland, meant crossing the North Atlantic it did not become popular until in the last generation when both British and American expeditions raced it neck and neck. The third one, of which the take-off is Point Barrow, Alaska, never has been conquered even to a mild degree. Such tragedies as DeLong's voyage in the *Jeannette*, our own naval enterprise, serve only to emphasize the desperate nature of tackling an untried arctic route.

But this is what Peary did. Nor was it simply a case of laying his ship on a different course, or threading his way through another sound or channel as other courageous explorers have. His plan was infinitely more daring. He chose the Greenland ice-cap.

Greenland is a great pear-shaped continent nearly 1,500 miles long, and something like 900 miles broad across its upper bulge. It is the classic example of the glacial age. Except for its rocky fringes and the southern tip, it is buried in ice. Depth of this frosting is conjectural. Along the coast 2,000-foot cliffs are literally dwarfed by the ice dome rearing back of them more than 9,000 feet into the sky.

To seek the Pole by the Greenland ice-cap could be compared to hunting a wild elephant by crawling up its back until close enough to shoot it behind the ear. A wild elephant's back is a tame comparison to that blizzard-tortured desolation Peary chose as his way north.

For practically ten years he fought a losing battle. True, he learned the technique of arctic travel from the natives; how to drive dogs; how to build snow igloos; how to exist on blubber and raw meat; how to wear skin clothes; how to hunt without firearms; how to sleep sitting up without a sleeping bag; how to burrow into a drift when taken unaware by a howling blizzard. He brought back three ponderous meteorites, one of them weighing ninety tons, the largest known to man. He collected a large quantity of information of scientific value as well as of popular interest. But so far as his ambition to reach the Pole was concerned he had failed.

Not until 1898 did he abandon the ice-cap. Old-timers said, "I told you so," when he admitted the Pole could not be reached that way. Also, they pointed out the foolish enthusiasm of youth and inexperience. Indeed, the injustice of the criticism Peary suffered at this critical stage of his life would have broken a weaker character.

He was forty now. He had battered away at a problem the geographical world declared could not be solved by the means he chose. That he had determined the insularity of Greenland was largely ignored. That he had made several ice-cap trips of over 1,300 miles, driving his own sledges and with no help save that of his tenderfoot companions, was not advertised. Yet Nansen, his contemporary, had secured a place of exalted fame from one summer's crossing of the narrow southern tip of Greenland. Nansen had food and Lapps and no back trail to figure on. Peary did five times the distance on little more than raw walrus meat and blubber. Eskimos helped him up the first glacier, then deserted him in terror at the prospect of travelling the great unknown interior.

The second period of Peary's northern work began in 1898 when he based on the opposite side of Smith Sound. By this time he had won the confidence of the natives. He realized the value of their dogs and meat. Greely, Kane, Hayes, and all the British expeditions up this coast had deprecated the Eskimo's value as an adjunct to arctic work. Peary cleverly recognized that no white man can pretend to lead his natural life in high latitudes. He trained himself and his men to be Eskimos. He went into their igloos and became one of them. He learned to eat their food, to wear their skin clothes, to perform the innumerable little tricks of keeping warm and dry that may mean the difference between life and death when caught in a sudden crushing snow-filled gale. When he crossed the Ellsemere Land he took enough families with him to provide hunters, seamstresses, and dog drivers.

It must be recalled that the upper left-hand (western) corner of Greenland converges with the land opposite. Arctic currents drag a jam of ice through this narrow passage. Open water is almost unknown. For this reason expeditions have usually disembarked in the Smith Sound region about 78° north

latitude, and made the rest of their way by sledge. Greely, Kane, Nares, and one or two others have happened to find open years which permitted them to base further north than Peary's earlier attempts. But their terrible loss of life and suffering offset any advantage they gained in the beginning.

Now began a new kind of work for Peary. On the ice-cap, despite its frightful wind and cold, smooth going was the rule. Coastal sledging means one unending struggle over the mountainous ice-jams that are formed by tide and current. On the ice-cap Peary had simply to grit his teeth and plug away. So long as he didn't starve or freeze, and held his course, all he had to do was to keep on lifting one foot after the other in order to reach his destination. Along the Ellsemere coast ten minutes of travelling on the level was a luxury that was stimulating. The average day consisted of a kind of exaggerated football game. Five hundred pound sledge load was the ball. Each driver carried, drove, pushed, and pulled his own. The opposing line was a serrated ridge of huge sharp ice fragments from ten to fifty feet high. And when by sheer strength and ice-axe this line was passed, there was always another just beyond. The enemy's tactics varied by cunningly placed lanes of open water, the most dangerous trap in the north.

It was a hard school, and Peary was a pupil for another ten years. It is interesting that this corresponds to the time he spent settling ice-cap delusion. But he was learning every day of it. His troubles came so fast that his publisher never gave him room to list them. On the Greenland coast he had only crushed his ankle on shipboard, lost a year's cache of stores on the ice-cap, and the like. On the Ellsemere coast he froze off every toe except a fraction of each large one. At Cape Sabine his Eskimos died like flies from a kind of dysentery. Only a few years ago the writer found the bodies of two of them wedged down between the boulders. Clothing had not even been removed from the mummified remains. Peary's white companions even pronounced him insane for the seemingly super-human campaigns he planned.

One misfortune after another assailed him at home. He was told that he would receive no more leave from the Navy Department. What this meant can be appreciated only in the light of

the ten years' struggle he had already endured for the sake of his ambition. His finances, never plentiful, ceased to exist. Only by dint of lecturing and writing to a degree nearly as exhausting as his travels over northern trails was he able to accumulate the pitifully scanty store of supplies and equipment he carried on these earlier expeditions.

These were the blackest years of his life. Earlier he had been able to exploit the novelty of his schemes as a means to further successive expeditions. The meteorites, the crossings of Greenland, and the like were stepping-stones to that notoriety so profitable to the lecturer and writer. Now the novelty had worn off. In despair he wrote to a friend:

"I seem to have reached the end of the lane. What I gained in Greenland I am losing in Ellsemere Land. Soon they will call me a fake, say I am just hoarding what I can mint from the public's credulity. Yet, would it profit me to confess that all my savings, all of my wife's savings, all I can beg, borrow, or steal, have gone into the quite inadequate equipment I have gathered for the next attempt?"

Such indomitableness is worthy of the best traditions of the navy.

It is difficult to realize the abysmal discouragements that sprang up on every hand. Members of earlier expeditions, broken by the inhuman toil of arctic sledging and embittered by the petty quarrels isolation breeds, lost no opportunity to backbite and discredit the man who they jealously realized was a better man than they. He dared to go again. Eskimos behaved with childish petulance when he returned without the promised gifts his anemic capital sometimes couldn't buy. And constant worry prevented his training like an athlete for the physical strain of his long exhausting trips. Instead, his naturally rugged constitution was sapped of its reserve endurance. Inanition was the logical result; and on practically all his later sledging Peary was a victim of what northern travellers call "starvation bloat." Formerly this distemper was erroneously thought to be scurvy. It is painful swelling of limbs consequent upon overwork and under feeding. Peary himself has described his sensations when suffering from it as the combination of "elephantiasis and toothache"! No more agonizing climax to his troubles could be conceived.

A flood of friendship turned the tide. Peary's magnificent tenacity had finally won him the attention and interest of a group of influential New Yorkers. When the Navy Department flatly refused to even consider further leave to prosecute more northern work, Mr. Charles Moore personally convinced President McKinley that the public would hold our government gravely culpable for cramping the energies of the one man who might redeem American geographical prestige so marred by recent arctic fiascoes. When burden of debt was about to place both Peary and his wife in legal toils Mr. Morris K. Jesup and a score of others reached down into their own pockets and produced. When the ordinary run of vessels fit for ice work still fell short of the strength required to face the polar pack, the *Roosevelt* was built. Peary's own designs were used.

The third period of Peary's life was now on. In the first he had made his ice-cap struggle. In the second he had crawled up and down the Ellsemere coast. He now launched his startling scheme to force a ship to the very shores of the Polar Sea. By basing there and with the help of dogs and Eskimos he might well hope to make the 500-mile dash to the pole and get back before spring leads cut him off. Only his intimate knowledge of ice and current conditions north of Cape Sabine made this plan in the least way possible. It was a long known fact that the very passage Peary selected was the most ice-choked hole north of the arctic circle. He had observed year after year that under certain combinations of wind and tide acting over limited combinations of shoal and deep, the ice jam suffered itself to be ripped and split until slender black leads of open water strung here and there between the Polar Sea and Smith Sound. Peary determined to gamble on the position of these leads. If the ship were caught she might suffer the fate of the *Proteus* which sank in eighteen minutes after being nipped. If he succeeded in getting through, safe return was even less likely.

He got through and he got back. He began to break records. In 1902 he made a new American record with 84° 17′ north. In 1906 the world's record was smashed when he reached 87° 06′ north. On April 6, 1909, he reached the Pole.

This was a many-sided triumph. Obstacles at home had been overcome. Ice navigation had been set a new standard by the

Roosevelt's performance. But beyond a shadow of a doubt the greatest factor in Peary's success was the remarkable sledging technique he had developed in twenty-five years of practice.

He worked on the unit basis. Logistics of his units were as perfect as mathematical reason could make them. A unit comprised one man, one sledge, and one team of dogs. This unit was independent and self-supporting for fifty days. The sledge carried about 650 pounds to start with. Of this 500 pounds of dog pemmican gave each animal one pound per day. Fifty pounds of hard biscuit and fifty pounds of man pemmican gave the driver a pound of each a day. A few gallons of kerosene, a tiny stove, tinned milk, tea, and some extra footgear and mittens completed the outfit.

A snow igloo will hold four men comfortably. A gallon of tea at night and another in the morning will keep four men going. Four men can just about handle one 600-pound mass over a seventy-foot ice pressure-ridge. One white man can keep three Eskimos busy, amused, fed, cheered, and loyal. Thus four men, one white and three brown, was the size of party Peary chose to group his helpers in.

Dogs and men have one characteristic in common, both easily and gladly follow where another has gone. This quality is an instinctive physical and mental laziness. For men or dogs to break their own trail is toil. It means concentration every moment to avoid pitfalls and rough spots. It means picking footholds. It means a kind of subconscious grief and jealousy over the ease with which those behind must come.

So members of each party of four took their turns at trail breaking. And when the whole party had been exhausted by a week or so of battering down ice walls, cutting ice roads, and plowing heavy snow, it stood aside and let the next party, fresh and eager, take the van.

This plan made it possible to line the trail with food. The advance patrol wore out physically before it had used all its supplies. It cached what it had, turned, and sped back light, leaving its extras for those to come. In this way physical energy of men and dogs was conserved. Land advance in the recent war was made by the same system of trail breaking and replacements that was used on the Polar Sea.

It is not difficult then to understand how Peary placed himself with fresh dogs, picked men, and adequate supplies within easy striking distance of the Pole. Conversely, it is not conceivable that a single unsupported sledge party could make the entire trip out and back as Cook claimed to have done. Peary's strongest trail breaking party collapsed at one quarter of the distance to be covered. Six groups were thus expended in blazing the way.

Peary has been scored for the unseagoing nature of his work. This and lack of affiliation with naval men necessitated by his long absences no doubt account for present professional disregard of his achievements. Even the Navy Department indicated grave doubt as to the ultimate value of his oceanic and other scientific investigations. And there existed an undeniable feeling that every year he spent north took him that much further away from nautical skill of any sort or degree.

No view could be more unjust. Few naval officers have had to face afloat the gauntlet of perils and difficulties Peary ran on every voyage north. His personnel consisted of scientific assistants wholly unversed in sea matters, and a motley crew of 'down-east' fishermen. Better classes of deck-hands and engine-room force would not sail away for an indefinite period on the meager wages Peary was forced to pay.

He had but one real aid, Bob Bartlett, who acted as a kind of executive officer so far as the ship was concerned. The two of them took the *Roosevelt* through thousands of miles of uncharted, unlighted, ice-filled seas. When the rudder was bitten off in an ice-jam they beached her and rigged a new one. When fuel ran out they dragged into a Labrador fiord and cut driftwood.

To illustrate his seamanship and his engineering ability, take one meteorite he brought back which weighed over ninety tons. The mass was well back in the hills. There was no dock to handle it from shore to ship. Time was painfully limited by constant snow storms, gales, and ice. Yet Peary wrestled the huge lump down, got it aboard his little vessel, and turned it over to the 100-ton crane in the New York navy yard without a hint that he was doing more than his normal duty. Compare this absurd equipment with that used at the gun factory in handling a six-

teen-inch gun or a weight similar to that of the meteorite, and some idea of the feat may be formed.

One remarkable aspect of Peary was his extraordinary veracity. A queer implication, no doubt. But in going back over records of other explorers it is almost impossible to find one that did not consciously or unconsciously exaggerate. It is so easy to create a false impression among those at home who are not familiar with arctic work. It is so safe and simple to fill in one's tale with details that make it vivid and alluring, yet which are no more true than the narrative of a novelist who knows his atmosphere and manufactures his episodes to fit. Peary never succumbed to this temptation. When he had gone his sledging limit he took the best sight he could, made the best notes his weary brain would permit, built the highest cairn his exhausted muscles could manage, and came home. This statement has been proved literally thousands of times. To the popular mind it means little; the popular mind loves to be duped. By the naval officer's standard there is no middle ground between truth and untruth. But to the world of science there is a middle ground, and it is by far the widest area of all research and information. Peary was the single explorer in the history of the north who entirely avoided it.

This same sense of truth and justice may have accounted for his ability to handle the varied elements of his subordinates. Eskimos are childlike. They are brave, devoted, trustworthy, and honest one moment; the next they may be just the opposite. Superstition can turn their courage to terror in an instant. Pique alone is sufficient to bring about desertion. Honor among most primitive races is a matter of convenience. To keep the services of such people through all the years he did, was a monument to Peary's tact and diplomacy.

Then there were his scientific assistants. The north can poison a white man's mind. Arctic neurasthenia is a common malady among Danish in South Greenland. Few expeditions have escaped insanity in some form or other. When the leader portions out skins and food and fuel he may be measuring the life span of his men. Fuel and food can be allotted with geometrical nicety. Skins and Eskimo assistants, routes, weather, and the like cannot. The white driver fights a blizzard, freezes, starves, thirsts, and sometimes dies, all the while cursing his leader for the

fractional partiality he seemed to have shown in assigning garments or the course of this particular trip. Peary's command used to return hating him in a way that murder couldn't gratify. Every arctic leader has had the same experience. When the antidote of normal life neutralizes the poison, this bitterness is gradually dissolved. But by that time all are separated and again engaged at home in their individual pursuits. While north, when friendly spirit is the one human bond, only the strongest character can rise above the terrible mental depression and irritableness which isolation and physical suffering bring. Peary could; he had the incentive. But those with him year after year could not. Only by magnificent patience and forbearance was he able to hold his authority over them with sufficient strength to utilize their aid to the end.

As navy men we cannot but admire such supreme qualities of command. To be sure aboard ship we have our uniforms and constant touch with Washington, routine, drill, and discipline to remind us of the authority vested in our superior officer. But even with all this there must be something more. There must originate in our leaders a spirit of professional cohesion which will permeate the entire ship's company and imbue them with a unity of purpose and ideal. This spirit must be strong enough to rise above discomfort, monotony of task, and every form of temperamental incompatibility. It is the priceless virtue which every officer spends his life in learning to master and to use. Yet, alas, how few are truly successful.

Arctic work magnifies the leader's difficulties a thousand times. Peary, for instance, had two masters and three groups of subordinates. He was answerable to the Navy Department and to his scientific backers; he had to direct and use successfully, first, a tribe of Eskimos; second, an always unruly crew; third, his special aids who were almost 100 per cent tenderfeet on every trip he took. His methods under the circumstances warrant the study of every one of us. His success deserves our most genuine pride. And the heroic tenacity of purpose that finally won him the goal of his life's endeavor, that took his life in the end, must be justly added where it belongs—to our capital of traditional service valor.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A BRIEF HISTORY OF THE INTERVENTION IN HAITI

COMMANDER R. B. COFFEY, U. S. NAVY

PRELIMINARY OCCURRENCES AT CAPE HAITIEN

In the spring of 1915 a revolution, led by General Rosalvo Bobo, began in Haiti against the government of President Vilbrun Guillaume Sam. As characteristic of all revolutions in this country the fighting began in the north. Until July the revolutionists had not got beyond Cape Haitien in their advance on the capital at Port au Prince.

On June 19 the French cruiser *Dès Cartes* landed a force of fifty men at Cape Haitien for the protection of foreign interests. On July 1 the commander cruiser squadron, Rear Admiral W. B. Caperton, U. S. N., who initiated and carried through the operations incident to the intervention, arrived at Cape Haitien with the U. S. S. *Washington*, under orders from the Navy Department to thank the French commander for his action and to take necessary steps to protect property and preserve order. The U. S. S. *Eagle* was assigned to his command and arrived at Cape Haitien on July 4.

At this time the government forces occupied Cape Haitien and the territory to the southward and westward. The revolutionary forces were close to the town approaching from the eastward of the Haut du Cap River (Sketch 3). In order to insure the protection of property and preservation of order, Rear Admiral Caperton informed the commanding officers of the contending forces that fighting in Cape Haitien would not be permitted and that he was prepared to land U. S. Naval Forces to lend effect to this decision. On July 9, when the fighting drew near the town, a detachment of one officer and twenty-nine marines from the *Washington* occupied a position on the Cape Haitien–Petite Anse

Road—the only road at that time open to the advance of the revolutionists, and the *Washington* and *Eagle* prepared to support quickly this detachment by further troops and gunfire. This landing was necessary to prevent a sudden rush of combatants into Cape Haitien. The position occupied by the marines was a strong defensive one across a peninsula, barely fifty yards wide, and well within supporting distance of both ships (Position A, Sketch 1). One flank rested on the Haut du Cap River and the other on the sea. This was the first landing of troops in Haiti. From then until July 27 order prevailed in Cape Haitien, while the fighting continued at intervals in the outlying country, and at times came within a mile of the town.

THE OCCUPATION OF PORT AU PRINCE

On July 27 information reached Cape Haitien that a revolutionary outbreak was occurring in Port au Prince; that the Guillaume government had been overthrown; that many political prisoners had been murdered in their cells; and that the President with other government officials had taken refuge in the French and Dominican legations. This information was confirmed in the course of the day by cable from the American Chargé d'Affaires at Port au Prince, who further stated that a forcible entry into the French legation was threatened to remove the President; that many had been killed in the course of the fighting; and that some foreign legations had cabled for men-of-war. The force on shore in Cape Haitien was immediately withdrawn and, at 8 P. M. July 27, Rear Admiral Caperton sailed for Port au Prince with the *Washington*, leaving the *Eagle*—Lieutenant Aubrey K. Shoup, U. S. N.—in charge of the situation at Cape Haitien.

The *Washington* arrived at Port au Prince at 11:50 A. M., July 28. Two staff officers were immediately sent ashore to investigate and report conditions. These officers found the situation practically as previously reported, but that an hour before the *Washington* arrived a mob of about sixty Haitians had forcibly entered the French legation and had removed and killed President Guillaume. Parts of his body were at this time observed being paraded about the streets. There was no government or authority in the city and chances of increasing disorder were great. The French legation was visited by these officers and the French

minister, the British Chargé d'Affaires, and the American Chargé d'Affaires were invited to go on board the *Washington* and confer with the Admiral.

It was realized at once that the interposition of American naval forces in the affairs of Haiti was necessary; and that, to prevent European complications which were most probable in view of the violation of the French legation, prompt action was required. The city was in anarchy, the excitement and riot were growing, and the danger to foreigners was increasing every moment. At 4 P.M. it was decided to land immediately and take charge of the city.

The landing force was placed under the command of Captain George Van Orden, U. S. M. C., and consisted of the *Washington's* marine detachment, the twelfth expeditionary company of marines, and three companies of seamen from the *Washington*—total about 340 officers and men. The only places where landings can be made at Port au Prince are directly in front of the city on the wharf (Position A, Sketch 2) and on the beach at Bizoton, about two miles to the westward of the city limits (Position B, Sketch 2). As nothing at all was known as to the nature and degree of resistance that would be encountered, as the city would be entered about dark with unseasoned troops, in view also of the topographical lay of the town, in which the native part lies with its long axis north and south, which would leave in the air both flanks of a force entering at the front of the town, and as the town could not be effectively cleared by an advance into its front, it was decided to land at Bizoton and enter the town on its south flank. This gave the troops a march of two miles on a broad road before resistance was expected, and afforded time to straighten out the men and get them in hand and in proper formation before coming under fire. It also permitted an advance through the town with one flank resting on the water front where it could be supported readily by armed launches, and in a direction which would allow the use of the ship's guns on the landing force's front without endangering our own men, should it become necessary to open fire from the ship. This plan, further permitted a free use of the ship's guns in a more sparsely settled area to cover the actual landing, when the men would be in boats in an unfavorable formation for meeting an attack. In short, it

CRUISER SQUADRON,
U. S. ATLANTIC FLEET,
U. S. S. WASHINGTON, Flagship,

Campaign Order
Number Four.

PORT AU PRINCE, HAITI,
Twenty-eight July, fifteen, four p. m.

FORCES:

(a) *Landing Force*
Captain George Van Orden.
Washington:
Two companies marines.
Three companies seamen.

(b) *Support*
Washington 10"-6"-3" guns.
Armed Launches.

1. French and Dominican legations entered by mobs yesterday and this forenoon and General Oscar and President Guillaume forcibly removed and killed.

No government or authority in PORT AU PRINCE.

French Cruiser Descartes expected PORT AU PRINCE tonight.

2. This force will occupy PORT AU PRINCE for the purpose of protecting life and property and preserving order.

3. (a) *Landing Force* land at once on beach near BIZOTON. Begin advance to occupy PORT AU PRINCE as soon as landed.

(b) *Support* support Landing Force operations.

Washington cover landing of Landing Force and support its advance to PORT AU PRINCE. Be prepared shift berth promptly to position off FORT ISLET.

Armed Launches in command Lieutenant Rhodes support left flank Landing Force and cover Water Front of town.

(x) Anticipate resistance. Avoid injury to non-combatants and their property.

4. Lieutenant Rhodes, Washington, take charge transportation of Landing Force to beach; assume duties of Beachmaster; return boats, less armed launches, to ship when landing is completed.

Washington provide maintenance and subsistence for Landing Force.

5. Squadron Commander on Washington. Use Flagship time.

Washington, armed launches, and Landing Force maintain signal communication.

(Sig) W. B. CAPERTON.
Rear Admiral,
Commanding Cruiser Squadron.

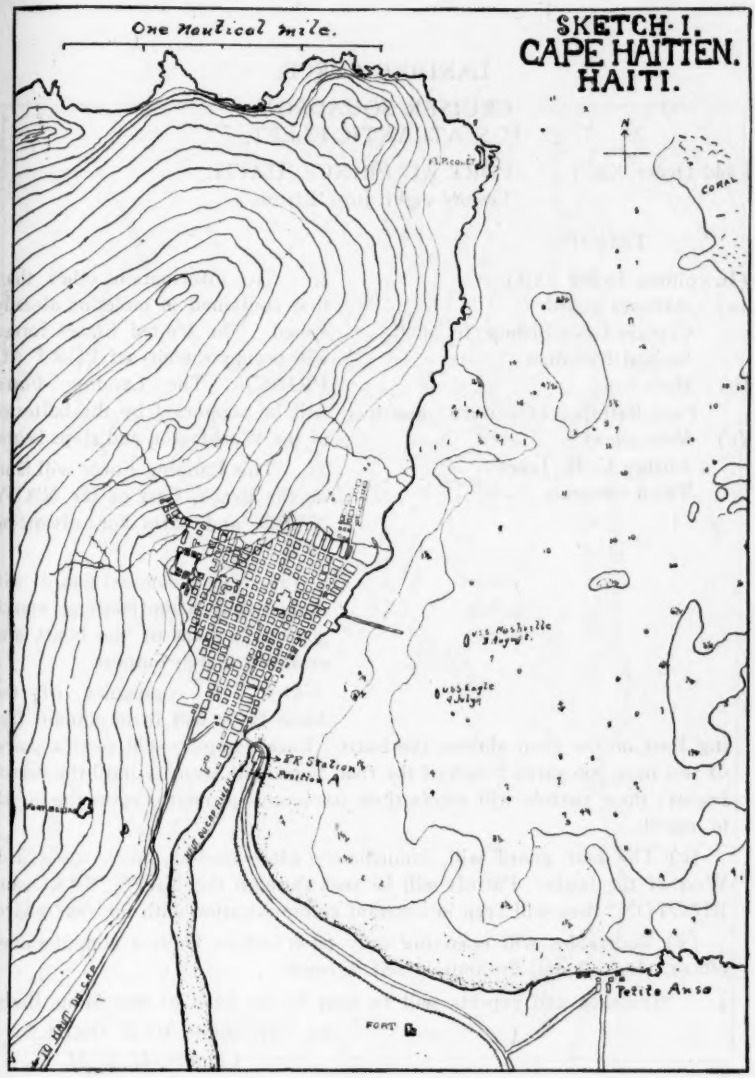
One Nautical mile.
SKETCH·I.
CAPE HAITIEN.
HAITI.
N
CORAL
Petite Anse
FORT

FIG. 1

LANDING FORCE,
CRUISER SQUADRON,
U. S. ATLANTIC FLEET,

Field Order No. 1. PORT AU PRINCE, HAITI,
Twenty-eight July, fifteen.

TROOPS:

(In column facing East)

(a) *Advance guard*
Captain Giles Bishop, Jr. M. C.
Second Battalion.

(b) *Main body*
First Battalion (less third company)

(c) *Rear guard*
Ensign C. H. Jones
Third company.

1. No information other than that contained in bulletins already issued. The United States forces will occupy the city of PORT AU PRINCE. The Landing Force will be supported by the batteries of the Washington and ships boats.

2. This Landing Force will land on the Beach, East of the NAVY YARD, and form for advancing on the city.

3. (a) The advance guard will immediately after landing, march 300 yards East of the boats and establish march outpost.

(b) The companies of the Main Body will form column facing East on the road abreast the boats. Each company will send a patrol of two men, 100 yards South of the road to provide security until the march begins; these patrols will rejoin their companies promptly upon the signal to march.

(c) The rear guard will, immediately after landing, move 100 yards West of the boats. Patrols will be sent through the NAVY YARD and BIZOTON; they will keep in constant communication with the rear guard.

(x) Companies will open fire only upon orders from a commissioned officer. Patrols will fire only in self defense.

4. Messages and reports will be sent to the head of the Main Body.

/S/ GEORGE VAN ORDEN,
Captain, U. S. M. C.,
Commanding.

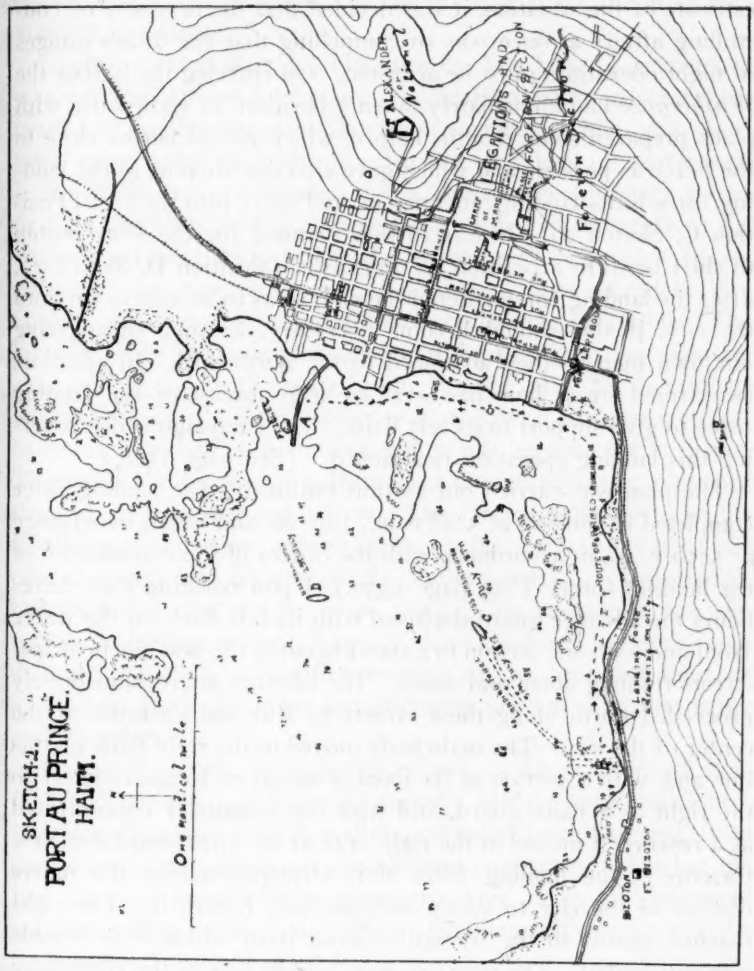
SKETCH 2.
PORT AU PRINCE.
HAITI.
One nautical mile
LEGATIONS AND FOREIGN SECTION
FOREIGN SECTION
Old
Landing for Admiralty party
FT. BRESTON

FIG. 2

was proposed to make a flank attack, rather than a frontal attack.

The landing so late in the afternoon was undesirable as it brought the men into the town at night, with all the disadvantages of night fighting with raw troops. However, after a careful estimate of the situation, it was decided that the necessity of controlling affairs at once was so compelling that the disadvantages of night operations must be accepted. On entering the harbor the *Washington* had immediately taken a position, in accordance with plans prepared some months before, which placed her as close to the beach as possible and which gave effective support to the landing force in its landing, advance to, and entry into the city (Position C, Sketch 2). It was further planned for the *Washington* to shift berth to a position off Fort Islet (Position D, Sketch 2), after the landing force entered the city, so as to be able to fire into the city, if this should become necessary, without endangering our own men as they advanced to the northward. In addition, two armed steam launches were to keep abreast of the landing force to give support to its left flank. The campaign order covering this landing operation is attached. (See page 1328.)

The plan was carried out as thus outlined. The landing force completed its landing at 5:48 P. M., July 28, and began its advance at 5:50 P. M., in accordance with the orders of the commander of the landing force. (See page 1330.) Upon reaching Fort Lerebours the advance guard deployed with its left flank on the water front and with one section to a street to cover the first five principal streets running north and south. The advance guard immediately proceeded north along these streets to Rue des Casernes at the center of the city. The main body moved to the right flank of this line and, with a section in its front, a squad on the next street to the right as a flank guard, and with the remainder concentrated as a reserve, it moved in the right rear of the line toward the New Caserne. The landing force thus stretched across the native district of the city to sweep all resistance before it. The right reached almost to the foreign section, from which little trouble was anticipated. The reserves were held in rear of the right flank to extend the line in that direction most promptly should trouble develop there.

As the advance began it became dark. During this advance considerable sniping occurred along the entire front of the left of

the line from civilians and soldiers. The resistance, however, was not organized and was promptly cleared away. None of our men were hit, but two Haitians were killed and ten wounded, including an officer. All armed Haitians were disarmed as they were encountered and a large amount of ammunition, rifles, and other war material was seized.

Upon arrival at Rue des Casernes the line halted and a guard was sent to the French legation. At the President's palace, which is next to this legation, a mob was encountered, which was, however, more noisy than hostile. In this mob was found General E. E. Robin, the commander of the Haitian revolutionary forces in Port au Prince. This officer was informed of the entry of the American forces and their purpose and was persuaded to accompany the commander of the landing force—Captain Van Orden—in an endeavor to prevent any further hostilities. The landing force had now passed beyond the foreign colony and resistance had practically ceased upon the arrival of the line at the Rue des Casernes. As it was now quite late, it was thought best to secure what had been covered and go into bivouac for the night. The twelfth company of marines was accordingly sent to guard the foreign legations and colony. The marine detachment of the *Washington,* however, proceeded on to the northern part of the city and went into bivouac at the Valliere market. The seaman battalion was sent to the same place. No resistance was encountered in these moves. Captain Van Orden and General Robin during the night visited different parts of the city; and together quieted the Haitian soldiers and otherwise prevented further firing and disorder.

The next day the *Washington* moved to the position off Fort Islet and the city was further secured: patrols were established, Haitians disarmed, armed bodies prevented from entering from the country, and arms and ammunition confiscated. During the few days following similar measures were taken for increased security. The marine guard from Guantanamo reënforced the landing force on July 29.

In this manner was Port au Prince occupied and military control assumed. That serious resistance was not encountered, was due to the prompt landing, the rapid and definitely directed advance, which did not allow the Haitians sufficient time to

prepare or to concentrate and gather their courage, and to the personal efforts of Captain Van Orden in visiting the Haitian detachments and securing the co-operation of their general. Some effect was also obtained by a previous warning, prior to the landing, carried to the Haitian leading men by Captain E. L. Beach, U. S. N., and Lieutenant J. N. Ferguson, U. S. N., to refrain from hostile acts and to all foreigners to keep within doors and show the flags of their nationalities. With the exception of some sniping on the night of July 29-30, some little unrest at times, and some other minor disturbances, Port au Prince remained orderly and quiet thenceforth.

At 10 P. M., July 28 a despatch was received from the Navy Department stating that the State Department desired that forces be landed at Port au Prince for the protection of foreign interests.

On July 29, after the city was occupied, Captain E. L. Beach, U. S. N., was sent ashore to assume the chief military functions and such civil functions as conditions might warrant.

On July 30 the French cruiser *Des Cartes* arrived at Port au Prince.

EFFORTS TO BRING GENERAL PEACE

Although there was now no government in Haiti, the fighting between the ex-government and revolutionary forces in the north continued. It was therefore thought highly desirable to take such means as were available to stop this fighting and to get the principal Haitian leaders to Port au Prince for a conference with the American officers, with a view of forming a new government. The Haitian Congress, which elects the President, was in session at this time and became anxious to proceed with the election. It was, however, restrained, pending conference with the Haitian leaders and the quieting of the excitement. To bring about a cessation of the fighting in the north a commission was formed by Rear Admiral Caperton of four prominent Haitians, the archbishop of the Catholic Church, and an officer of the admiral's staff to act as chairman and the United States representative. This commission proceeded to North Haiti and consulted with the leaders of the opposing forces at their headquarters.

While this commission was at Cape Haitien, the ex-government commanding general, Probus Blot, deserted his troops and went to Santo Domingo. Upon this, disorder broke out in Cape Haitien

and the Bobo troops attempted to enter. The ships present, which now consisted of the *Nashville* and *Eagle* under the command of Commander P. N. Olmstead, U. S. N., immediately landed their troops; occupied the position on the Petite Anse Road to prevent the entry of Bobo's forces (Position A, Sketch 1); contained in the property of the church and on the Haitian gunboat, *Nord Alexis,* the ex-government forces, which without a leader had sought refuge there; opened fire with the *Eagle's* guns ahead of the Bobo troops, who were advancing along the Petite Anse Road into the town, and drove them back; established guards and patrols; seized all arms and ammunition; and thus in the course of a few hours had effectively occupied Cape Haitien without loss of life or unusual disturbance. The action of Commander Olmstead at this time was most opportune. By its rapidity and definite direction, he had seized the second city of Haiti in the midst of the contending factions and thus prevented to a large extent serious disturbances in that area.

Upon the desertion of Blot the ex-government faction dissolved, with the exception of the ex-government troops under General Bourand, who were still holding Ouanaminthe and the frontier in that vicinity. Bourand was therefore the principal leader remaining in arms against Bobo.

The Caperton commission induced all factions to cease fighting; and persuaded Bobo, twenty-six of his generals, and Bourand, to return with it to Port au Prince for a conference with the Admiral. The leaders agreed to hold their troops in the positions then held, pending the results of the conference. Upon arrival at Port au Prince the rival leaders were informed that they would not be allowed to become factors in the political situation as long as they had troops under their command. Accordingly, both Bobo and Bourand sent telegrams to their various chiefs to proceed to Cape Haitien and turn in their arms to the American forces there.

On August 4 the second marine regiment arrived at Port au Prince on the *Connecticut* and the commanding officer of the regiment, Colonel Eli K. Cole, U. S. M. C., assumed the military duties on shore at that place.

Every effort was made to disarm and disband all Haitian soldiers who could be rounded up. The ex-government forces,

which were captured by the *Nashville* and *Eagle* at Cape Haitien, were sent to Port au Prince; and there paid off and disbanded to the number of seven hundred and sixty-six. All men under arms not within the American lines were offered a fair price for their rifles, if they would come in and surrender them to the American forces. In this way several thousand rifles were obtained, and, in addition, other war material was seized. The *Connecticut*, after landing the second regiment at Port au Prince, proceeded to Cape Haitien and on August 6 reinforced the *Nashville* and *Eagle* at that place. It was found necessary at this time to take action against revolutionary activity, which still survived in the form of "revolutionary committees" in Port au Prince and Cape Haitien. These committees were accordingly dissolved and informed that further activity on their part would not be permitted.

THE FORMATION OF THE NEW GOVERNMENT

With the arrival of the principal leaders in Port au Prince and the establishment of more quiet and peaceful conditions, the election of the president by the Congress was allowed to proceed. It soon developed that the principal candidates were Bobo and Sudre Dartiguenave—the president of the senate. Bobo's support depended entirely on his ability to control armed forces and their time-immemorial power of exerting military pressure on the Congress. In order to prevent further military intimidation of this nature, Port au Prince was combed to clear from the town all ex-soldiers and especially the Cacos, who were in the town upon our entry to the number of about fourteen hundred. These Cacos were the lawless bandits of the north, who were the mainstay of all revolutionary armies. They possessed the greatest fighting ability of any class of Haitians; and, by their military organization, when bought by the various revolutionary leaders, had been the controlling factor in Haitian politics for many years. To them and the unscrupulous leader who hired them, had been due the constant turmoil of revolution in the country. With Port au Prince carefully guarded against outbreak, the election was held on August 12. Dartiguenave was elected president. Bobo left the country and went to Jamaica. Bourand accepted the situation and retired to private life. Instructions were soon received from Washington to support the Dartiguenave government.

PRELIMINARY TREATY NEGOTIATIONS

It was early recognized that the time was most opportune to bring to a successful conclusion the negotiations, relative to the United States control of customs, finances, and other matters, which had been pressed diplomatically, off and on, with Haiti for many years previous, without success. The sentiment of the Haitians and the situation in this respect were carefully estimated; and, as a result, the State Department was urged to renew its efforts along these lines at this time. The State Department accordingly, through the American Chargé d'Affaires, Mr. R. B. Davis, submitted to the Haitian government a preliminary draft of a treaty on August 17. This treaty provided for direct American control of customs, supervision in an advisory capacity of all government finances, the organization of an American officered constabulary which should be the sole military force in Haiti, and have the sole charge of all military material and its traffic, and the right of American intervention to suppress trouble and to enforce the provisions of the treaty.

THE CONSOLIDATION OF UNITED STATES CONTROL

On August 15 the first regiment of marines arrived at Port au Prince on the *Tennessee*, thus forming an expeditionary force of two regiments (four battalions) of marines, under the command of Colonel L. W. T. Waller, U. S. M. C. One battalion of the first regiment was sent to reënforce the troops at Cape Haitien and the remainder was landed at Port au Prince. These troops were afterwards reënforced by a battalion of marine field artillery. In order to insure the food supply to Port au Prince and to make more secure the American position, the towns of St. Marc, Petionville, and Leogane were occupied as advanced posts.

On August 19 orders were received from the Navy Department to assume charge of all custom houses at the maritime ports of entry of Haiti, except Mole St. Nicolas, Aquin, and Fort Liberte. It was further directed that all revenues thus accruing be collected and applied to the organization of a constabulary, to the carrying on of public works to provide employment for the destitute, and to support the Dartiguenave government; and that the remainder be held in trust for the Haitian people. In accordance with these

CRUISER SQUADRON,
U. S. ATLANTIC FLEET,
U. S. S. WASHINGTON, Flagship,

Campaign Order Number Nine

PORT AU PRINCE, HAITI,
Five September, Fifteen; Ten a. m.

FORCES:

(a) *First Detachment*
Captain E. H. Durell
Connecticut
Nashville
First Regiment Infantry less Second Battalion.
One Battery Field Artillery.

(b) *Second Detachment*
Commander J. F. Carter
Castine
Seventh and Twenty-Fourth Companies Infantry.

(c) *Third Detachment*
Major N. H. Hall
Sixth and Twelfth Companies Infantry.

(d) *Fourth Detachment*
Commander L. McNamee
Sacramento
Fourth and Seventeenth Companies Infantry.

(e) *Main Body*
Washington
Marietta
Eagle
First Brigade Infantry less One Battalion and Six Companies.
One Battalion Field Artillery less One Battery.

1. The Cacos still remain in arms in North HAITI. South HAITI is at present quiet. Negotiations relative to the treaty with present HAITIAN government are continuing. This government without funds and not at present strong; efforts to strengthen and support it are continually underway.

2. This force will assume and maintain military control of the ports of entry of HAITI and collect customs thereat; pending negotiations between UNITED STATES and HAITI.

3. (a) *First Detachment* maintain military control PORT DE PAIX and military government CAPE HAITIEN. Nashville patrol PORT DE PAIX and CAPE HAITIEN. Connecticut support these operations.

(b) *Second Detachment* maintain military control ST. MARC and GONAIVES. Castine patrol ST. MARC and GONAIVES and support these operations.

(c) *Third Detachment* occupy JEREMIE. Maintain military control PETIT GOAVE and MIRAGOANE.

(d) *Fourth Detachment* occupy LES CAYES (AUX CAYES) and JACMEL. Sacramento patrol LES CAYES and JACMEL and support these operations.

(e) *Main Body* will maintain military control under martial law at PORT AU PRINCE. Washington support these operations. Marietta patrol PETIT GOAVE, MARAGOANE and JEREMIE and support Third Detachment. Eagle continue repairs.

(x) Maintain military control and administer customs at all ports occupied. Protect life and property and preserve order. Disarm all HAITIAN troops encountered.

4. Base is at GUANTANAMO. Osceola will make trips between base and various detachments with stores, mail and provisions. Jason and Solace remain PORT AU PRINCE for the present.

5. Squadron Commander on Washington. Make daily and such other reports as may be necessary to keep Squadron Commander fully and frequently informed of the situation. Use seventy-fifth meridian mean time.

(Sig) W. B. CAPERTON.
Rear Admiral
Commander Cruiser Squadron,
Commanding United States Forces
in Haiti and Haitian Waters.

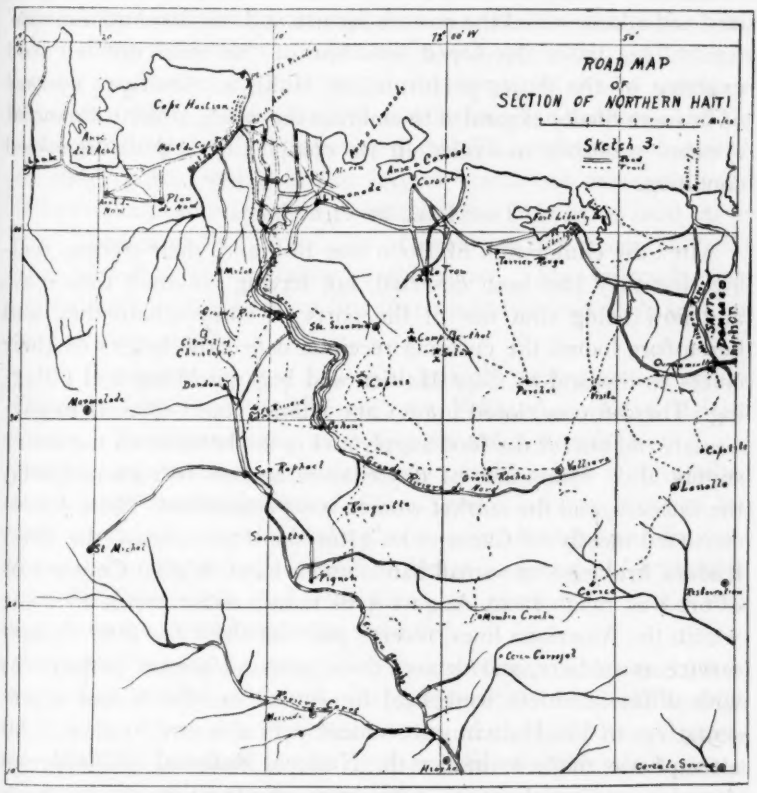

FIG. 3

orders all the ports of entry mentioned were occupied. A company of marines and a gunboat seized each port and paymasters of the navy assumed the duties of collectors of customs and captains of the port. By acting in each case promptly and with sufficient force to overwhelm at its inception any resistance, all the ports were occupied without loss of life. In this manner the ports of Jacmel, Les Cayes, Jeremie, Miragoane, Petite Goave, Gonaives, and Port de Paix, in addition to those already held, were occupied. These ports extend along a coast line over five hundred and fifty miles in length. Aquin and Fort Liberte were occupied later. The order covering these operations is attached (Fig. 3).

Paymaster Charles Conard, U. S. N., was appointed administrator of customs and fiscal officer. Under him were organized and administered the custom service and the fiscal administration. This latter developed into one of the most difficult and exacting of the duties performed in Haiti, as American control of finances finally expanded to embrace the whole Haitian financial system—probably unrivaled in its complexity and disorganized condition.

THE FALL OF THE CACOS

After the elimination of Bobo and Bourand, their troops, feeling that they had been deserted, not having obtained their pay, and now being shut out of the ports of entry where they had heretofore looted the customs receipts, defied the orders of their chiefs to disband at Cape Haitien and began robbing and pillaging. These forces closed in on Cape Haitien and Gonaives in particular, and cut off the food supply and in the latter town the water supply also. Many acts of depredation against foreign property, the farmers, and the market women were committed. These forces consisted mostly of Cacos, who after the departure of the chief leaders, broke up into small bands under local chiefs. Continuous effort was made from August 3 to induce these bands to come within the American lines, receive pay due them for their former service as soldiers, and deposit their arms. Various conferences with different chiefs were held by American officers and representatives of the Haitian government with this end in view. An attempt was made to induce the National Railroad of Haiti—an American corporation—to begin new construction work on its road under military protection with a view of inducing the Cacos

to go to work. But all this was of no avail. The marauding and banditry continued. By the middle of September the Cacos became so annoying and their blocking of the food supply to Cape Haitien and Gonaives so serious, that more stringent action became necessary.

The commander of the expeditionary force—Colonel Waller—accordingly made a reconnaissance along the Cape Haitien–Grande Riviere Railroad (Sketch 3), and consulted with various Caco chiefs. As a result the railroad was opened and the famine conditions in Cape Haitien relieved. The same action was taken at Gonaives; and the railroad from Gonaives to Ennery was opened, but not without resistance from the Cacos, who opened fire on our troops and attempted to tear up the railroad. They were dispersed with a number killed and wounded. In order to insure no further molestation of the food and water supply to these two towns, orders were issued to keep the railroads and the roads entering them continuously open. The coffee crop in transit to these ports, which is the largest source of income to the industrious portion of the inhabitants, was also being held up by the Cacos; and the importance of securing free access for this crop added to the necessity of this move. The railroads were accordingly kept open from this time on and patrols were sent out on the main roads.

On September 26 two American patrols were attacked on the Haut du Cap–Cape Haitien and the Petite Anse–Cape Haitien Roads. Reënforcements were sent to these patrols from Cape Haitien and the Cacos were driven away with a loss of fifty killed and a large number wounded. The American forces suffered ten men wounded. On this same day another engagement between the Cacos and a patrol occurred at Petite Riviere de L'Artibonite. The Americans lost one man killed, no wounded. The Cacos lost three men killed and nine wounded.

In order to keep peace and order more effectively and to control the situation, martial law was declared by Rear Admiral Caperton in Port au Prince on September 3; and extended to all places occupied by American troops on September 20. This had a most salutary effect for betterment of conditions and made more definite the status of the forces on shore.

Efforts were continued to induce the Cacos to surrender their arms and disband by the offer of their pay and the granting of amnesty by the Haitian government. On September 28 a written agreement was finally reached in which the Cacos agreed to surrender their arms on definite dates to the American forces and to submit to the authority of the Haitian government. The Cacos in return were to receive 50,000 gourdes for each 1,000 soldiers with serviceable rifles. It was further agreed that any Cacos found in arms, after the dates on which the arms were to be turned in, were to be treated as bandits. Although bound by this agreement, the Cacos by dilatory and delaying action completely evaded its terms—comparatively few arms were surrendered and marauding and pillaging broke out afresh. This was probably due to the weak hold the big chiefs had on the smaller ones, the inclination of the Cacos to live by pillage rather than by peaceful work, and the agitation of irresponsible persons who for one reason or another were opposed to the Dartiguenave government and the American occupation. Toward the end of October sniping against the American patrols grew worse and finally culminated in an attack on the American forces at Le Trou (Sketch 3). The Cacos were repulsed in this attack with six killed. The Americans had one man wounded.

These occurrences necessitated systematic operations to clear North Haiti of the Caco bandits. The area occupied by them at this time was in the northeast corner of Haiti, contained within the line Cape Haitien–Dondon–St. Raphael–Pignon–Carice–Ouanaminthe–mouth of Massacre River–Cape Haitien—about seven hundred square miles (Sketch 3). The plan adopted was to divide this area into two parts, separated by the line of the Grande Riviere; to clear first the eastern part and then the western, using the railroad for communication and supply purposes. The eastern part was to be entered from the north and from the south, while forces held the line of the railroad and the Grande Riviere as far south as Bahon, and the border and eastern side as far south as Valliers. In this manner Forts Capois, Berthol, and Selon—important Caco strongholds—would be attacked. Then the western part would be cleared, including Fort Riviere, the most difficult of all strongholds, due to its strength and inaccessible position on the top of a mountain over twenty-five hundred feet high.

A force of about one thousand marines and seamen were collected in the north and under the command of Colonel Waller began these operations on November 1. By the fourteenth, after continuous skirmishing with the Cacos, Forts Capois, Berthol, Selon, and the neighboring strongholds were captured and the districts in their vicinity cleared. In these fights the Cacos would not stand, but with their superior knowledge of the trails managed to escape each time. It was soon learned that what was left of organized resistance was gathering at Fort Riviere. It was therefore recognized that if the Caeos at this place could be forced to stand, the campaign could be brought to a definite conclusion in one blow.

The location and approaches of Fort Riviere were accordingly thoroughly reconnoitered. The plan was to drive in the various Caco outposts and to advance simultaneously on the fort from four directions: one column from the northward via Dondon, another from the westward and southward via San Raphael, one from the eastward, and one from east and southeast via Bahon. In addition other troops closed the remaining routes of escape. The movement was executed as planned. On November 17, after a spirited engagement involving ten minutes of hand to hand conflict, Fort Riviere was captured and the last organized resistance and the reign of the Cacos destroyed.

This little campaign lasted less than three weeks—from November 1 to November 17. During that time over five hundred square miles of country were covered. This country is of a most difficult and mountainous character, covered with thick tropical growth, and pierced almost solely by rough foot trails. The men marched and fought continuously, sometimes covering twenty miles a day and most of it hard mountain climbing. Bluejackets, clad in khaki, vied with marines in their efforts; and after a few days seasoning became good "hikers". The American losses amounted to only one officer and one man wounded. That there were not more is a monument to the discipline and training of the personnel. The success of the plan was in a great measure due to the efficiency of supply and communication organized by the marines, and to the "spirit of the offensive," which drove the troops after the Cacos wherever they could be found.

COMPLETION OF THE TREATY NEGOTIATIONS AND RECONSTRUCTION

With the capture of Fort Riviere all trouble in North Haiti ceased, and peace was brought to the entire country. By the end of 1915, Haiti throughout was quiet; peaceful pursuits were being resumed; farms, houses, and villages were being rebuilt; sections, of late years depopulated, reinhabited; and the general aspect of the country was one of returning prosperity. American troops continued to patrol all districts, but were gradually finding helpful aid in the newly organized constabulary, which, under the training and guidance of marine officers, amounted on February 1, 1916, to thirteen hundred well equipped men. Outside of the usual petty thievery and minor conspiracy, no further disturbance was anticipated.

From August 17 the treaty negotiations continued, with many "pourparlers" and discussions. On September 16 the treaty, substantially as submitted by the United States, was signed by the plenipotentiaries of the two governments and on October 6 and on November 11 ratified by the two chambers of the Haitian Congress. Upon signing the treaty the Dartiguenave government was recognized by the United States. On November 29 a "*modus vivendi*," placing the treaty into full working effect pending ratification by the United States Senate, was signed; and on December 6 a commission of Haitians proceeded to Washington to arrange details for its operation.

It was thus by these military operations with the attendant martial law, the seizure of control of all Haitian finances, and the successful accomplishment of the treaty negotiations, that a century of bloodshed was brought to an end and Haiti was placed under the virtual protectorate of the United States. The United States assumed, by these acts, the responsibility of insuring that its own important interests in this area and the interests of other nations and humanity in general would be henceforth served in peace and profit.

U. S. S. "DeLong" Ashore at Half Moon Bay

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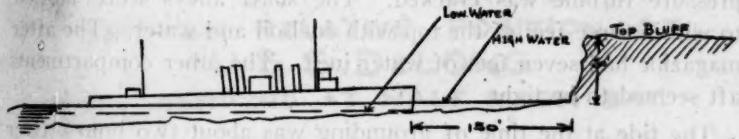
U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SALVAGE OF THE U. S. S. "DELONG" (#129)

By Lieut. William Nelson, (CC) U. S. Navy

The Destroyer *DeLong* while en route from San Diego to San Francisco running in a fog at about ten knots grounded about two and a half miles south of the northern end of Half Moon Bay, California, at 2:43 A. M., December 1, 1921.

The vessel was being steered a course of 42° true, accompanied by the *Babbitt* and the *Tatnall*, the *DeLong* leading; and by emergency signals warned both the *Babbitt* and the *Tatnall* sufficiently in advance to keep them clear. Although a heavy surf is running continuously in the vicinity of Half Moon Bay, the officers reported that no indications of their being in shoal waters were evident until the ship struck bottom. Breakers during normal winter weather break about four hundred feet from the shore line in about two fathoms of water.



SECTION
SHOWING POSITION OF
U.S.S. DELONG WHEN
AGROUND

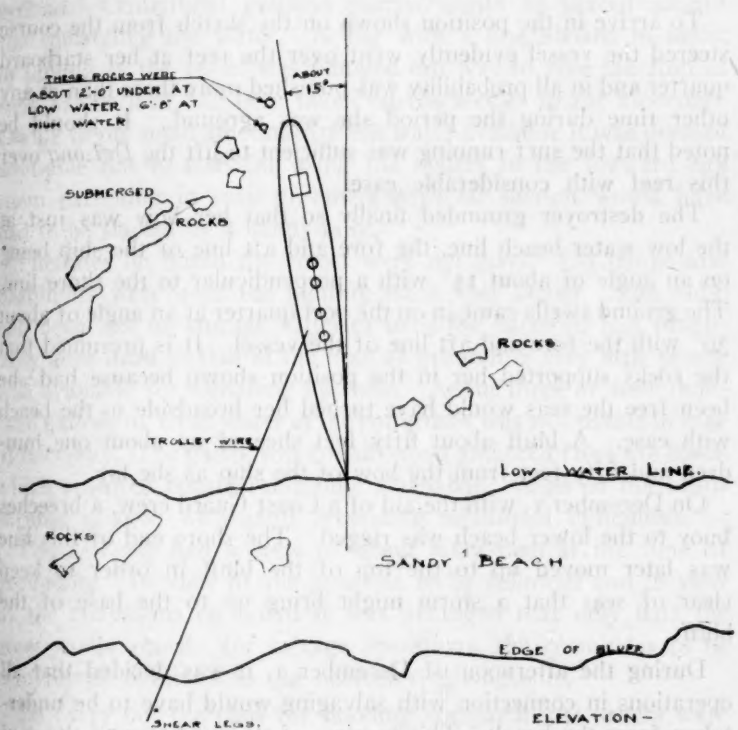
Immediately upon grounding the order was given to "back full," "left full rudder," and "sound the siren." The general alarm was sounded, break-down lights were turned on and word passed to close all water-tight doors. The boilers were running on the after fuel oil tanks. Suction was lost shortly after the engines had begun to "back." Efforts were made to get up steam

again but evidently due to broken joints in the oil-line the attempts were unsuccessful. Water commenced entering the engine rooms and the after boiler room through strained seams and rivets. No holes in the shell plating were noted. Orders were given to "secure" below and for all hands to come on deck for muster. Exact conditions as regards the shore line were not known but it was thought best not to lower a lifeboat. The port anchor was dropped but orders were given not to take a strain on the cable. All weather deck hatches were closed.

The next morning an inspection of the vessel throughout revealed that all compartments forward of the forward boiler room were tight. The shell plating and one frame in the forward magazine were bent but no signs of leakage appeared. A little water was being taken in the forward fire room but the source could not be ascertained. The two stanchions in front of the boilers were slightly bent. The after fire room had a bulge in the shell on each side of the keel under the floor plates, and a stanchion on the starboard side between the boilers had buckled at the head and had bent the deep beam. One pump frame was bent and fuel oil lines were bent. Water was being taken quite rapidly in this compartment. In the engine rooms the shell plating on the starboard side was dished considerably. Frames and pipe lines in the bilges were badly bent, fuel oil was entering these compartments from the after fuel oil tanks. The port low pressure turbine was cracked. The shaft alleys were flooded to within three feet of the top with fuel oil and water. The after magazine had seven feet of water in it. The other compartments aft seemed to be tight.

The tide at the time of grounding was about two hours after high water. The highest spring tide of the month came the day of the grounding, but owing to lack of facilities for pumping no advantage could be taken of that tide. Further, the increased draft of the vessel due to her taking water made it more doubtful than ever that she could be removed without pumping.

During the flood tide of the following day the vessel moved further inshore about fifty feet, placing her in the position shown on sketch "A" and that position she held until she was finally pulled off.



SKETCH "A"
SHOWING RELATIVE POSITION OF U. S. S. DELONG WHEN AGROUND AT HALF MOON BAY.

The bottom in Half Moon Bay is sand and rock—the rocks running in strata at an angle with the shore line. In some places these outcroppings of rocks come up in pinnacles quite close to the surface of the water. The rocks in the vicinity of the *DeLong* when aground are shown in the sketch. In addition to those shown, there is reason to believe that there were one or two rocks under the ship itself, but since they were not seen they are not plotted. The strata of rocks on the beach if plotted out would place a rock under the after boiler room of the vessel. (This is presumed since a stanchion in this compartment was buckled more than any other.)

To arrive in the position shown on the sketch from the course steered the vessel evidently went over the reef at her starboard quarter and in all probability was punished more there than at any other time during the period she was aground.. It should be noted that the surf running was sufficient to lift the *DeLong* over this reef with considerable ease.

The destroyer grounded finally so that her bow was just at the low water beach line, the fore and aft line of the ship being on an angle of about 15° with a perpendicular to the shore line. The ground swells came in on the port quarter at an angle of about 30° with the fore and aft line of the vessel. It is presumed that the rocks supported her in the position shown because had she been free the seas would have turned her broadside to the beach with ease. A bluff about fifty feet sheered up about one hundred and fifty feet from the bow of the ship as she lay.

On December 1, with the aid of a Coast Guard crew, a breeches buoy to the lower beach was rigged. The shore end of this line was later moved up to the top of the bluff in order to keep clear of seas that a storm might bring up to the base of the bluff.

During the afternoon of December 1, it was decided that all operations in connection with salvaging would have to be undertaken from the beach. This in view of the condition of the surf and the nearness of the vessel to the shore. In this connection it might be well to mention that relatively few salvage operations are undertaken from the shore, because in most cases there is sufficient water alongside the vessel grounded, to permit taking a light draft tug or barge alongside with pumps and other gear, and operating in general from the seaside of the stranded ship. However, in this case everything had to be done from the bluff one hundred and fifty feet from the bow of the *DeLong*.

So it was decided that the *DeLong* should be loaded down with water in enough compartments to make her rest securely on the bottom at the highest tides until all preparations could be made for pumping her out and pulling her off. This was done to prevent pounding and to prevent the vessel turning broadside to the beach. It was then planned that moorings would be placed to seaward on the port and starboard quarters. Tackles to these moorings would be used to give the vessel her first start off the

ground. Centrifugal gasoline pumps would be placed aboard for controlling the water. A tug with a line aboard to assist in pulling as the vessel was pumped out was to take the ship as soon as one fleet had been taken on the tackles to the moorings. Owing to the small amount of fresh water available it was deemed advisable not to consider using the boilers in the forward fire room excepting in case of emergency; oil suction would have had to be started by a handy-billy.

Facilities on board the vessel were not good. Oil lamps and flashlights were used for lighting while they lasted. The radio had been run on storage batteries until the batteries had practically gone dead so that at the time of grounding very little power was available for signalling by radio. About three or four thousand gallons of fresh water in the cofferdam was still usable in case of necessity. The galley was run on wood gathered from the beach which required considerable time and labor. Most of the heads became clogged with sand presenting additional difficulties.

The *DeLong* had a crew of about sixty men at the time of grounding. In view of the program to be followed and in view of the conditions on board it was arranged that only half the crew would remain for salvage operations, the remainder to be transferred overland to the nearest receiving ship.

To carry out the plan for flooding compartments orders were given to flood full the fore peak, the commissary storeroom, the construction storeroom, the after peak, and the steering engine room and to flood to the level of the floor plates in the forward fire room. The water in the engine rooms and the after fire room rose and fell with the tide, lagging somewhat. Marks on the bulkhead indicated that the vessel had rolled about 20° to the side since these compartments had taken water. It was believed that this weight of water would be sufficient to keep the vessel steady unless extremely high tides accompanied by a heavy sea occurred.

The means to be employed for flooding consisted of a handy-billy and a bucket line. It was later found that the suction to the handy-billy became clogged with sand upon the slightest provocation. The bucket line was slow. The steering engine room was flooded easily by removing the main deck hatch and allowing the seas breaking over the vessel's stern to fill this com-

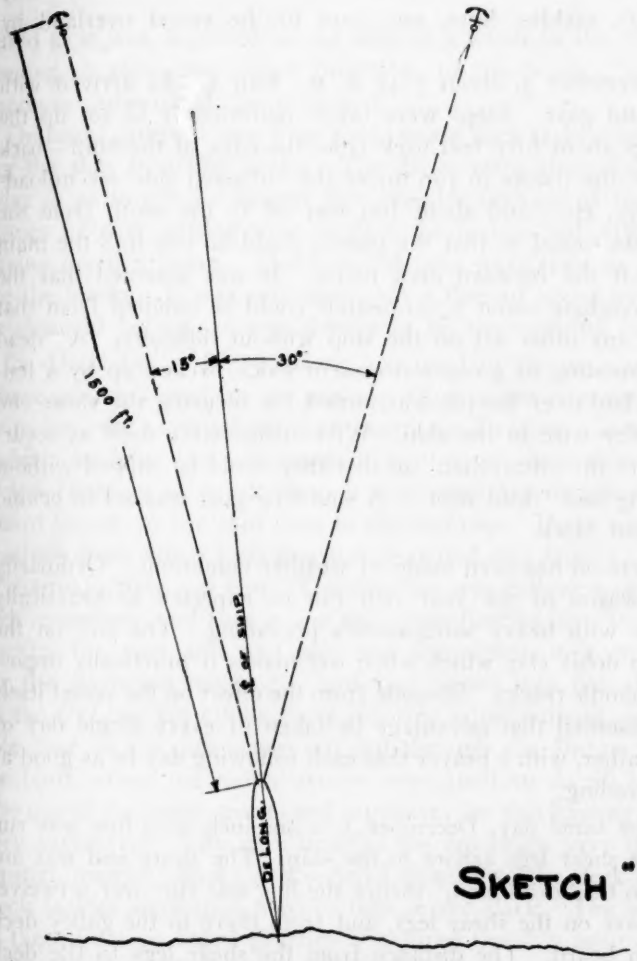
partment. The boiler room was flooded by opening a connection to the sea. The commissary storeroom was flooded by the bucket line. No means of flooding the construction storeroom and the fore peak seemed to exist.

Soundings taken around the vessel at high water gave depth of water as follows:

Frame	*Starboard*	*Port*
22	1¾ fathoms	1½ fathoms
32	1¾ fathoms	1½ fathoms
42	1¾ fathoms	1½ fathoms
52	1¾ fathoms	1½ fathoms
62	2 fathoms	1¾ fathoms
72	1¾ fathoms	1¾ fathoms
82	1¾ fathoms	2 fathoms
92	1½ fathoms	2 fathoms
102	1½ fathoms	1¾ fathoms
112	1¾ fathoms	1¾ fathoms
122	1¾ fathoms	1¾ fathoms
132	1¾ fathoms	1¾ fathoms
142	1¾ fathoms	1¾ fathoms
152	1¾ fathoms	2 fathoms
162	2 fathoms	2 fathoms

On December 2, at high tide the ship became very restless, rolling 4° or 5° to the side. This made it important that more water be taken aboard, so orders were given to flood the forward boiler room, six feet over the floor plates. In addition a drainage line from the steering engine room to the construction storeroom was broken in the storeroom, flooding that compartment from the sea through the main deck hatch in the steering engine room. This seemed to secure the ship so that there was practically no movement whatsoever.

Arrangements were made to have a tug lay two 5,000 pound anchors as shown in sketch "B" and to pass wire lines from these anchors to the *DeLong*. The chart showed six fathoms of water where the anchors were to be planted. The anchors were actually planted so that the mooring on the port side was 17° on the quarter at a distance of 1,406′ and the mooring on the starboard quarter 5° at a distance of 1,336′. Since time was the essence of the undertaking the moorings were left as planted the first time. The object of the larger angle on the port quarter was



SKETCH "B".

SHOWING LOCATION OF MOORING ANCHORS U.S.S. DE LONG, AGROUND.

to pull the vessel away from the rock reef on the starboard quarter.

Orders were given to have one five-inch and one four-inch centrifugal gas pumps, gasoline, suction hose, acetylene lamps,

shear legs, tackles, lines, etc., sent to the vessel overland by trucks.

On December 3, about 7:45 A. M., four trucks arrived with pumps and gear. Steps were taken immediately to set up the shear legs about fifty feet back from the edge of the bluff—back to permit the trucks to run under the outboard side for unloading pumps, etc.—and about 100 feet off to the south from the bow of the vessel so that the pumps could be run into the main deck abaft the forward deck house. It was assumed that the pumps weighing about 3,700 pounds could be handled from that point to any other aft on the ship without difficulty. A "dead man" consisting of a one ton cement block backed up by a ten-foot log laid over the top was buried for securing the shore end of a trolley wire to the ship. Wire straps were used as securing end to the "dead man" so that they could be slipped without reclaiming said "dead man." A snubbing post was set in behind the cement block.

No mention has been made of weather conditions. Ordinarily at this season of the year rain can be expected at practically any time with heavy southwesters prevailing. The soil on the bluff is a dobie clay which when wet makes it practically impossible to handle trucks. So aside from the effect on the vessel itself it was essential that advantage be taken of every single day of good weather, with a prayer that each following day be as good as that preceding.

On the same day, December 3, a one-inch wire line was run from the shear legs ashore to the ship. The shore end was anchored to the "dead man," thence the line was run over a twelve-inch sheave on the shear legs, and from there to the galley deck house on board. The distance from the shear legs to the deck house was 350 feet. This meant considerable sag due to the weight of the line. If it could have been arranged, the end aboard ship would have been placed high enough so that material could have been run right in on deck without rehandling. Nothing as easy as that seemed possible so the ship end of the trolley wire was run around the galley deck house twice and clamped to itself. The slack was taken in on shore by chain falls—a five-ton chain fall with the best available chain snorters was the only thing that gave satisfaction. An objection to this line se-

cured as it was, it pulled on the ship as a whole in the direction tending to move the vessel broadside to the beach. The advantages outweighed the objection.

On board, preparations were made to rig deck tackles for starting the ship from the beach. The decks were cleared on both sides so as to get the longest fleet possible because of the small chance of ever getting time to fleet the tackles out after once having taken a heave. The forward bitts were used as the fix for the blocks. It was estimated that a fleet of about 50′ could be obtained before we would have to let the mooring lines go.

On December 4, the wrecking tug used to lay moorings and whose gear was used for the major portion of the salvaging stood by to send the mooring wires on board the *DeLong*. It was impossible to have the tug come in any closer than about 1,500 feet on account of breakers so it was necessary to use a Coast Guard launch to fire shot lines to the *DeLong*. These were successfully fired with a Lyle gun and 18-pound shot from a distance of approximately 500 feet. The shot line was followed by a five-inch messenger and then a one and three-fourths-inch steel wire line on the port side and one and five-eighths-inch steel line for the starboard mooring. Sufficient power was not available on the *DeLong* for taking these mooring wires without considerable time so the messenger was led through the *DeLong* up to the bluff where the motor trucks were used to do all hauling. The use of the motor trucks and purchases for this hauling proved very successful. The wire lines to the moorings were taken in through quarter chocks and secured directly to the deck tackles. Deck tackles were then used to take in the slack. The securing of these lines on board practically assured the ship against turning broadside to the beach. Naturally the port line was the more important, so greater care was exercised in taking in all the slack on that line.

After further study of the conditions it was decided that additional pumps would be required to handle the water and oil as desired. The ground swells coming in would not permit pumping out compartments in succession without damaging the vessel unnecessarily due to pounding. Further, due to the lift that would exist in some compartments it was necessary to figure on having a steam pump in operation. This steam pump was

also extremely advantageous in removing the oil and in priming the gas pumps. Additional pumping capacity also seemed necessary to take care of compartments that might be damaged when the vessel was pulled off.

The *DeLong* was divided into the following sections for pumping:

Section 1. All compartments forward of forward boiler room.
Pumping: Ship's booster pump and a 4" gasoline centrifugal pump. (This certifugal pump was not set up but was placed on board ready to be used as needed).

Section 2. Forward and after fire rooms.
Pumping: One six-inch gas centrifugal pump, capacity 900 gallons per minute.

Section 3. Forward engine room.
Pumping: One eight-inch centrifugal gas pump, capacity 1,600 gallons per minute.

Section 4. After engine room, and "D" oil tanks.
Pumping: One eight-inch centrifugal gas pump, capacity 1,600 gallons per minute.

Section 5. All after compartments.
Pumping: One four-inch reciprocating steam pump. (Worthington Duplex).

In addition to the above one five-inch centrifugal gas pump and two handy-billys were to be placed aboard as spares.

The above arrangement of pumping was later changed as will be noted.

On December 5, preparations were made on board the *DeLong* for taking the pumps. It was planned on putting all pumps on the main deck with the exception of those in the boiler room and engine rooms. The deck was burned out for the six-inch pump to the forward boiler room so that it could be landed on the grating about eight feet below the main deck. The engine room hatch to the forward engine room was removed and a swinging platform about four feet below the main deck was arranged for the eight-inch pump to be placed there. The pump for the after engine room was to be placed over the hatch to that compartment.

Additional slack to the moorings was taken in by purchases. This caused the ship to change her heading 5° to the right but

at low tide she moved back to her original heading. It is interesting to note that the *DeLong* seemed to swing back and forth over an arc of about 5° on all high tides after that. This seemed to indicate for a certainty that she was resting on a rock somewhere near the after boiler room.

For working nights, acetylene lamps were used and although very successful for local lighting, they are not good for lighting at a distance.

During the evening of December 5, the additional pumps named above, suction hose, lumber, coal, gasoline, barrels, water, a donkey boiler for the ship, and a donkey engine for the shore end of the trolley, arrived.

The trolley was operated by a four-inch line for easing out and a two-inch line for hauling to the ship. The donkey engine made this particularly easy for hauling the weights down the trolley.

As soon as the gear was rigged, pumps, hose, etc., were sent to the ship. Shear legs on board were used to lift the weights on board after their arrival alongside; the trolley wire could not be set up taut enough to run the weights over the rail.

Even transportation by motor truck presents difficulties. One motor truck weighing eight tons without a load, carrying a load of about ten tons was arrested by the police for traveling overload, the limit of weight allowed being eight tons. Another motor truck loaded, smashed into a ditch bridge which required rebuilding before the other trucks could come in. Invariably on bad pieces of road towing had to be resorted to, to get loaded trucks through.

On December 6, work in connection with landing pumps and gear on board the *DeLong* was continued. Efforts were made by the salvage tug to move the starboard mooring out farther but without success.

The clearance between the edge of the bluff and the trolley wire was not sufficient to permit clear passage for some of the larger weights, so efforts were made to blow out the bank with black powder. All reasonable weights of powder had very little effect—picks and shovels had to be resorted to eventually.

In view of the time required to take a fleet on the deck tackles it was planned that as soon as the *De Long* had been started from the beach, the salvage tug and the navy tug would take a strain

on their lines to the *DeLong* and keep her moving until she reached deep water. To this end it was arranged that the salvage tug would have a one-inch wire line and the navy tug a ten-inch manila line.

The one-inch wire line was passed to the *DeLong* and taken in through the stern chock and made fast. The ten-inch manila line was not to be run until just prior to the actual pulling on account of possible damage to the line through chafing.

The six-inch pump in the forward fire room was tried out as soon as it was set up. It pumped that compartment practically dry in fifteen minutes. The compartment was flooded again before high water.

Calculations were made for stability assuming location of center gravity and assuming free water in practically all lower compartments. No *Inclining Experiment* booklets were on board, so at best the calculations were only approximate. However, they showed that sufficient metacentric height existed for any moderate conditions. Calculations were also made for capacity of pumps and water to be handled, etc. These calculations proved that capacity was satisfactory.

On December 7, miscellaneous gear was put on board the *DeLong*. The pumps throughout were tried and found to control all waters with considerable ease. When the six-inch pump in the forward fire room was run with suction in the after fire room the water in that fire room and in the two engine rooms dropped simultaneously indicating that those three compartments were open to each other. No changes in pumps and suctions were thought advisable, however, because of the desire to have the pump capacity there. This later proved desirable because the openings between compartments were comparatively small, making it more desirable for each compartment to have its own pump.

In view of the difficulty of handling oil with a centrifugal pump the oil in the engine rooms and in the after oil tanks was pumped out with the four-inch steam pump and sea water allowed to come in to replace the oil pumped out.

Efforts were made at various times to pick up the port anchor, that had been dropped shortly after grounding, both by the use of the capstan and by lines to the bluff, but the anchor chain had

become so fouled in the rocks that sufficient power was not available to break it out. Since plans were developing for pulling the vessel as soon as possible, it was deemed advisable to slip the anchor and forty-five fathoms of chain cable.

Weather conditions had been quite favorable up to this time with a moderate swell running continuously. It was feared that good weather would not prevail much longer, so plans for pumping out and inspecting were cancelled and arrangements were made for pumping and pulling the vessel off the beach at high tide between 6:00 and 7:00 A. M. the eighth of December.

A five-sixteenths-inch wire line had been run as a messenger for the ten-inch going to the navy tug, but it carried away before the ten-inch line was bent on. It was then too late to try another messenger so orders were given that in case of a pull the next morning the two tugs would pull in tandem on the one-inch wire line to the *DeLong*. To reduce the breaking of the surf as much as possible fish oil was put over by the salvage tug beginning at midnight. This fish oil had very little or no effect whatsoever on the breaking of the surf. This result was predicted since the waves were made by ground swell and not by a wind. The sea was watched during the night for signs of change. Unfortunately the sea kept increasing until at daybreak a very heavy swell was coming in with breakers in six or seven fathoms of water. This was entirely unlooked for, so rather than unnecessarily hazard personnel and material the pulling of the vessel was postponed until more favorable conditions prevailed —waves were coming in three and four a minute. The barometer was steady, the wind north, with a heavy mist.

The heavy seas of that morning had washed up over the ship so as to spray all the pumps on the main deck putting them out of commission until the magnetos could be dried out. It showed however that houses would have to be built over the pumps to protect them. Accordingly houses built up of one-inch lumber with canvas covering were placed over the pumps on the two engine rooms. The doors in the after deck house displayed signs of weakness so they were shored with 2″ x 4″.

It was estimated that the draft when the vessel ran aground was about 9′ mean. If all the water and oil could be removed it was figured the draft would be about 8′ mean. Consequently

to get as much oil out forward as was possible to reduce the draft a steam connection was made from the donkey boiler to the booster pump in the forward boiler room. Although this pump was submerged practically continuously it was run successfully. Only a small quantity of oil was pumped out however, pending a definite date for pulling the vessel.

During December 8, the sea showed no signs of moderating, making it fairly certain that nothing could be done on the morning of December 9. Plans were then made for attempting the pull December 10 on the morning high tide.

On December 9, the sea had moderated a little but waves were still breaking over the stern of the *DeLong*. Gear on deck had been washed around unmercifully making it imperative that additional lashing be done on everything. Doors in the after deck house had been broken in by the seas. These were later straightened, replaced and reshored. In addition the ventilator opening in the after side of the after deck house had shipped so much water that the crew's space aft was flooded up about 4′.

Previously it was arranged to have the two tugs pull in tandem on the one-inch wire line, but in view of the possible necessity of having to pull the *DeLong* off in a moderate sea it was considered advisable to have each tug pull its own line so that if one carried away, the *DeLong* would still be in tow. The mooring lines would have to be let go early in the game, it was figured.

The sea showed no signs of moderating very much so plans for pulling the 10th of December were changed to the 11th of December.

On December 10 minor preparations were made and gear checked over to see that all was in readiness. It was intended to pull even with a moderate sea. A ten-inch manila line, 2,100 feet long, buoyed with gas drums and beer kegs was run from the tug to the *DeLong*. The end on the *DeLong* was passed around the after deck house and made fast there. The manila line was secured to a one-inch wire line on the towing engine on the tug.

At about 8:00 P. M. December 10, a heavy sea commenced running in, the *DeLong* rolling slightly under the strain. As time went on the sea kept getting rougher until about 11:00 P. M. when the tug with the ten-inch manila line reported that she had

parted her anchor chain and requested permission to slip her line. The tug with the one-inch wire line reported a rough sea with breakers alongside. Both vessels were ordered to slip their lines and to proceed to a point of safety. Before the one-inch wire line could be slipped, however, it carried away. The *DeLong* kept becoming more restless, so much so that her safety at high tide was feared for. It was then near low water. About four hours before high water "all hands" were ordered ashore.

During the high tide the vessel swung back and forth through about ten degrees. She was swinging on a point near the after boiler room as near as could be determined. In addition she was rolling slightly with each swing. Seas were breaking over the ship flooding the main deck as far forward as the galley deck house. The wooden houses around the pumps carried away. The after side of the after deck house was crushed so badly it was necessary to plank it, and shore it throughout.

Although the sea showed a tendency to moderate, all plans for moving the *DeLong* that date were canceled.

Sometime after high tide December 11, all hands returned aboard to straighten out the gear and to prepare for the next chance. Pumps were tried on the various compartments to see if the compartments had opened up any more but no signs of increased openings to the sea were found.

Arrangements were made for camping the entire crew ashore in tents made out of the ship's awnings. After December 11, the crew slept and took their meals ashore. The principal reason for having the crew ashore during high tide was that practically the entire after half of the *DeLong* was washed by seas, and further there was the danger of having the port mooring carry away, and then having the destroyer turn broadside to the beach and the seas, where pounding would soon have broken up the vessel.

Houses over the pumps were rebuilt of 2″ x 12″ stuff with 6″ x 6″ for framing and shoring. Fortunately this withstood all the seas after that. The canvas on the house over the forward engine room caught fire from the exhaust to the pump located there, but little damage was done before it had a chance to reach oil. (Oil seemed to be on everything from the engine rooms aft.)

On December 12, the sea had moderated considerably. During the morning high tide the *DeLong* rolled easily but she was ship-

ping seas as far forward as the galley deck house. Efforts were made by the salvage tug to pick up the one-inch wire line but it had fouled the rocks near the mooring anchor and could not be salvaged. The lead to the *DeLong* was cut clear so that there would be no danger of its fouling the *DeLong's* propellers. The ten-inch manila line was picked up by the navy tug with ease and she stood by riding as before. A seven-inch manila line, 1,900 feet long, was ordered to replace the one-inch wire line to be run from shore at daybreak the thirteenth. Preparations were made to pull the *DeLong* at 7:00 A. M. the thirteenth.

On December 13, a fog had set in so thick that the stern of the *DeLong* could not be seen from the bluff. Plans for pulling that morning were cancelled. The launch used for firing shot lines tried firing lines at daybreak, and owing to the fog had so much difficulty in seeing, that on two occasions the shots landed in the midst of the crew working on the bluff. By using a fog horn and a policeman's whistle for signalling, orders to await clear weather were sent to the launch and the tugs.

It was particularly desirable to commence pulling the vessel on the morning high tide since it was the highest tide; and further, because it was more desirable to move the ship during daylight when the lines could be seen to better advantage. However, so many things had intervened cancelling the movement on a morning tide, that it was decided that the vessel would be pulled morning or night provided lines were ready and sea moderate.

The ten-inch line to the tug had been out so long that its strength was questioned. Consequently it was tested by a pull at low tide and it parted about 600 feet from the *DeLong* where it had chafed on rocks. The two pieces were picked up immediately and arrangements were made for running it on the morning of December 14.

The low tides of this period permitted the rocks near the starboard quarter to be seen. A pinnacle was so near the vessel, and so nearly dead astern, that the only hope of clearing these rocks was to pull towards the North before the pull for deep water was commenced. Even then there was danger of the bow falling down on them.

On December 14 the ten-inch manila line to the tug was run satisfactorily. The pumps were started immediately after the

line was run but it was so near high water that advantage of that high tide could not be taken. It was decided, however, that the after compartments would be kept partly pumped to keep the seas from washing over the stern. Some of the shoring over the after deck house doors had been carried away, so it was necessary to again rebuild and resecure aft to keep the water from washing into the crew's compartment aft.

On December 15, at about 7:00 A. M., the seven-inch manila line was run to the salvage tug and all the pumps again started. The vessel had a list of about 5° to starboard to begin with but as the water was pumped out the list kept increasing. High tide was at 10:00 A. M. All lines ashore were cast adrift with the exception of the breeches buoy lines which were slackened only. The sea was moderate. As the water was pumped the *DeLong* kept listing to starboard until a 19° list was reached. The engine room pumps lost suction then leaving about six feet or seven feet of water in each of the engine rooms and nine in the forward boiler room. This meant that all suctions would have to be lowered to reduce the water to a point where the ship would commence to right herself. The danger in the list lay in that seas could easily break into the engine rooms through the hatches making it practically impossible for the pumps to handle that additional water. Efforts were made to lower the suctions but the oil and water in the compartments made it so difficult that is was impossible to get the work done on that tide. Further there were no signs of the list decreasing until the pumps were all stopped and water again taken in.

In view of the difficulty experienced it was decided that a five-inch gas pump be used on the after compartments, Section 5, leaving the steam pump to be used wherever it served best. In addition a "T" with gate valves on each suction with suctions to each of the fire rooms was placed in the line to the six-inch pump in the forward fire room. This was done to avoid handling the suction hose from one compartment to the other.

All of the night of December 15 and all day of the sixteenth were used in shifting suctions lower and nearer the center line. The troubles connected with handling six-inch and eight-inch suction hose in water and oil below the floor plates in fire rooms and engine rooms of a destroyer can only be known to one who

has experienced it. Floor plates, floors, and pipes are only a portion of obstructions.

The sea had increased on the sixteenth and at high tide the *DeLong* rolled and yawed considerably.

Compartments were inspected for additional damage caused by the list but no signs of increased injury could be found.

On December 17 high tide was due at 11:25 A. M. All preparations had been completed at 8:00 A. M. The two tugs were standing by with their lines. The weather was good and the sea smooth. The ship was rolling easily under the ground swells. At 8:30 A. M. all pumps throughout were started. As the water was pumped out strains were taken on the lines to the moorings—the hauling part of the port tackle was handled by the donkey engine ashore, the hauling part of the starboard tackle was handled by the ship's capstan. All pumps were working satisfactorily, the water in the ship dropping rapidly. At 10:00 A. M. the navy tug was ordered to pull to the north at an angle of about 30° with the fore and aft line of the *DeLong*. Strains were kept on the deck tackles. At 10:15 A. M. the *DeLong* moved off the beach, stern swinging to the north clear of the reef; no pounding of consequence was noted. The breeches buoy lines were cast off. Both tugs were ordered to pull. Gradually the vessel moved away from the shore. As soon as it was seen that all was going well the mooring lines were burnt off and cast clear. The tugs handled the *DeLong* well into safety.

When the *DeLong* went aground her rudder had been put hard to port. The rudder was seen to be about 25° to port when the vessel was inspected December 1 but since then the stern had been so deep in the water that the rudder could not be seen. Further the steering engine room had been full of water practically all the time so the rudder was still connected to the steam engine. It was planned that as soon as the steering engine room could be pumped dry steering would be done by hand. But in order to get underway without delay one tug was placed in tow of the *DeLong* with an eight-inch line for steerageway, while the other tug towed the *DeLong* with a ten-inch line. At about 10:30 A. M. the tow commenced. The pump in each section was run until it lost suction and then the compartment was allowed to fill until the pump could again pick up suction. At best about three feet

of water and oil remained in the lower compartments that the suctions could not reach. Soundings were taken at intervals and it was noted that practically all compartments below the berth deck were leaking. The forward compartments, however, were taking water slowly so no large pump was put on this section. The booster pump in the forward fire room kept the water in the forward oil tanks down.

After about an hour of towing the rudder hand gear was connected up and hand gear tried. The rudder seemed to move easily so the tug in tow of the *DeLong* was cast off. The *DeLong* was drawing about nine feet forward and twelve feet aft, giving her a decided trim by the stern. Large angles of helm were used to begin with but not until orders to use small degrees of rudder were given was it noted that she seemed to answer better with small helm. It is interesting to note that upon arrival at the navy yard, Mare Island, after having passed through all the channels satisfactorily the rudder was discovered to be missing, the stock only remaining.

The trip from Half Moon Bay to navy yard, Mare Island, was made without incidents, excepting the parting of the ten-inch manila line and substituting a wire tow line, at speeds varying from one knot per hour to six knots per hour. The vessel bucked an ebb tide practically continuously after entering the Golden Gate.

The *DeLong* arrived at Mare Island about 11:30 P. M., December 17, and was placed in dry-dock for examination immediately upon arrival. No information being available as to her damage the dock was prepared according to the regular docking plan.

A general survey of the bottom after the vessel was docked showed the following damage:

The rudder excepting a small section above the gudgeon was gone (very likely broken off during the heavy weather of December 10 and 11). The bottom was badly dented from bow to stern and leaked badly through leaky seams, butts, loose rivets, empty rivet holes. There was one dent in the keel about two frame spaces between the struts and the rudder post. In two places the keel was bowed up between bulkheads so that it was nearly a foot above the base line.

Weather reports from Half Moon Bay indicate that exceedingly bad weather set in the week following December 17.

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THE UNIVERSAL DRAFTING MACHINE AS A BATTLE APPROACH INSTRUMENT

LIEUTENANT COMMANDER D. T. HUNTER, U. S. NAVY

During the strenuous gunnery program of the Pacific fleet in the season of 1919-20, while the writer was on duty as navigator of the U. S. S. *Idaho,* approaches for the different forms of practice were a part of nearly every day's work.

Being dissatisfied with the various methods of using the mooring board for this problem, on account of the inaccuracy of the circles and graduations, it was decided to try the drafting machine with the ordinary cross-section paper supplied to ships, and the results were uniformly good.

No originality is claimed for the method, but conversations with other officers who have recently been navigators of battleships, developed the fact that none of them had ever seen this particular combination used, so it was thought that it might be of interest to others in the service.

The equipment used in the *Idaho* was very simple, consisting of an ordinary drawing-board, hinged to a batten which was lashed to some conduit pipes on the conning-tower wall, directly under the target-bearing indicator. The opposite edge of the board was fitted with a single hinged leg, so that the board, when not in use, hung vertically against the wall. A spare drafting machine anchor, secured permanently in the upper left-hand corner of the board, a camp-stool and a rack for pencils, dividers, and stop-watch completed the outfit.

A sheet of cross-section paper, cut from a large roll, covered the whole board, and the long rulers supplied with the drafting machine were graduated to the same scale (inches and tenths) as the cross-section paper. The advantage of the cross-section

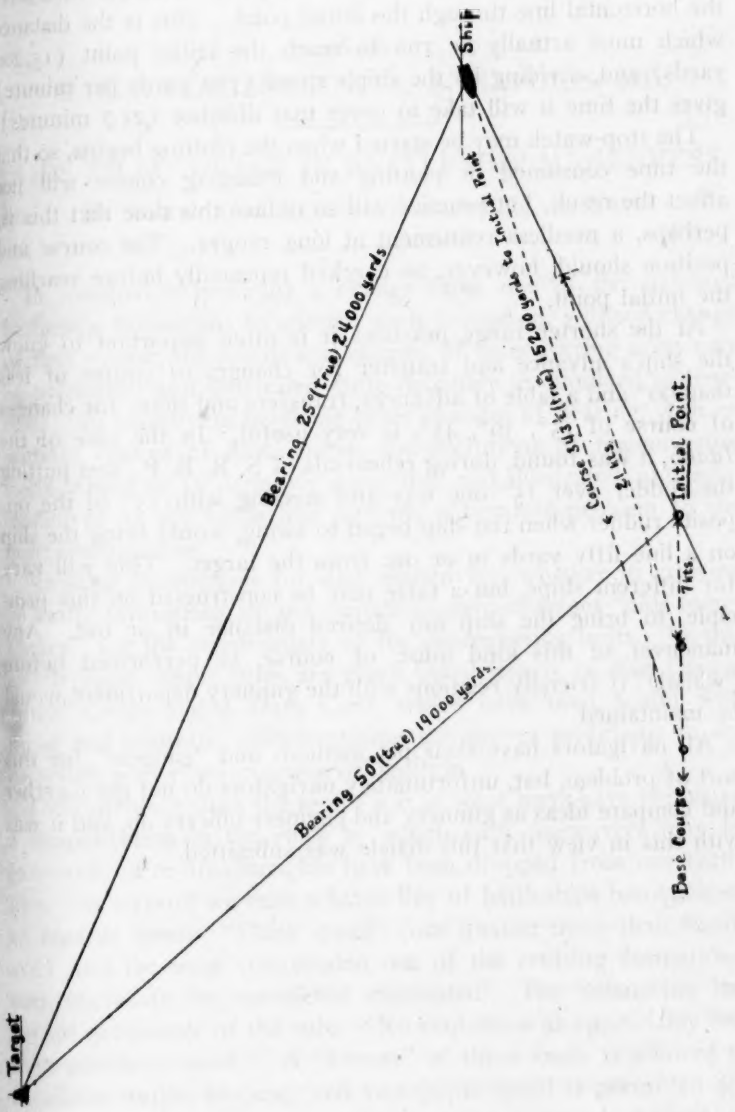
paper and similarly graduated ruler is the great variety of comparatively large scales which is available for any approach problem. It was the writer's practice to use a scale of 1″= 200 yards for S. R. B. P., 1″= 500 yards for S. R. D. P., and 1″= 1,000 or 2,000 yards for the longer range practices.

The target was represented by a pin driven into the board near the middle of the upper edge, through the intersection of two of the heavy lines of the paper, to facilitate alignment of the ruler while plotting. It is also advisable to plot the towing vessel at the proper distance ahead of the target, for use in case the latter should be temporarily obscured.

The heavy horizontal line, containing the pin, was always taken as the base course of the target and if the practice involved firing on both sides the course was reversed by simply reversing the compass rose of the drafting machine. The required track of the ship for the practice, and all important bearings and points were plotted on the sheet in red ink and prominently labelled.

The operation of plotting involved no new principles, but for the sake of clearness as to the use of the gear it will be described briefly. The ship's course and the bearing of the target are obtained from the target-bearing indicator, and the range from a J. W. talker stationed beside the chart board, so that the ship's position at any instant can easily be plotted by distance and bearing. The method of reaching the initial point may best be illustrated by an example. Suppose it is desired to reach an initial point from which the target will bear 50° to the right of the base course, distant 19,000 yards; base course North (true); target speed 7 knots; ship's speed 21 knots; and that the target now bears 25° (true), distant 24,000 yards.

First orient the drafting machine, plot ship's position and draw a line connecting it to the initial point. Consider the initial point to move forward on the base course at the target's speed and lay off from that point, to any convenient scale, a distance representing 7 knots, in the direction of the base course. With the end of this line as a center and a radius equal to 21 knots (to the same speed-scale) strike an arc to intersect the line joining ship's position and initial point. Press the points of the dividers into the board, lay the drafting-machine ruler against them and clamp the machine. This gives the course to steer (343-1/2°


Ship
Bearing 25°(true) 24000 yards
Course 313½(true) 15200 yards to Initial Point
21 kts.
Initial Point.
7 kts.
Bearing 50°(true) 19000 yards.
Base Course
Target

true). Leaving the ruler clamped, lay it through the ship's position and measure the distance to the point where it intersects the horizontal line through the initial point. This is the distance which must actually be run to reach the initial point (15,200 yards) and, dividing by the ship's speed (700 yards per minute) gives the time it will take to cover that distance (21.7 minutes).

The stop-watch may be started when the plotting begins, so that the time consumed in plotting and changing course will not affect the result, but practice will so reduce this time that this is, perhaps, a needless refinement at long ranges. The course and position should, however, be checked repeatedly before reaching the initial point.

At the shorter range practices it is often important to know the ship's advance and transfer for changes of course of less than 90° and a table of advances, transfers and times for changes of course of 15°, 30°, 45°, is very useful. In the case of the *Idaho*, it was found, during rehearsals of S. R. B. P., that putting the rudder over 15° one way and meeting with 15° of the opposite rudder when the ship began to swing, would bring the ship on a line fifty yards in or out from the target. This will vary for different ships, but a table may be constructed on this principle, to bring the ship any desired distance in or out. Any maneuver of this kind must, of course, be performed before "whistle" if friendly relations with the gunnery department would be maintained.

All navigators have their pet methods and "gadgets" for this sort of problem, but, unfortunately navigators do not get together and compare ideas as gunnery and engineer officers do, and it was with this in view that this article was submitted.

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AIDS TO ACCURACY IN BATTLESHIP MANEUVERS

By Commander Russell Willson, U. S. Navy

In maneuvers involving a change from one of the standard battleship formations to another such formation, without change of fleet course, the speeds and courses of maneuvering units may be prescribed and illustrated quite definitely in standard instructions. In maneuvers involving other changes of bearing, with or without change of fleet course, the evolutions of maneuvering units cannot be so definitely prescribed and illustrated, and each maneuver of the battle line presents a separate problem to the unit commanders.

Existing instructions for such maneuvers, whether in cruising or battle formations, do not include many convenient "aids to accuracy" for the commanders of the maneuvering units. In this article some simple rules are given based largely on two Course Angle Cards and a Data Card, which have been found both rapid and accurate, in determining the proper evolutions to accomplish prescribed changes of position.

Developments since the recent war in some ways have permitted a simplification in the rules by which such maneuvers may be executed. Pre-dreadnoughts have been dropped from our battle line. As a result we have a battle line of battleships homogenous as regards speed. "Flank speed" (one quarter more than standard) and the most complicated one of the cruising formations, may therefore be considered eliminated. The submarine has forced acceptance of the rule—"No evolutions at appreciably less than standard speed." A "leeway" of three knots is allowed to facilitate station keeping, and two-thirds speed is permitted for base units under certain conditions (the assumed absence of enemy submarines), but in general it may be said that the com-

mander of a maneuvering unit, during battle line maneuvers, is troubled but little by the question—"what speed?"

Normally, if a maneuver requires that a unit advance its bearing, it takes full speed, otherwise it uses standard speed. Should the maneuver involve a considerable change in interval, standard speed may be indicated when the bearing is to advance or full speed when the bearing is to drop back. However, when once in formation such occasions are unusual. The important question for the unit commander is—what course and when?—and it is here that aids to accuracy are valuable.

The Course Indicator and Mooring and Maneuvering Board (H. O. 2665) are the best "aids to accuracy" now available. Unfortunately, it cannot be said that all officers are familiar with them. But it can be said, and truthfully, that someone on the flagship of the best handled division is familiar with both. It may be added that someone on the flagship of the worst handled division is probably unduly familiar with the "seaman's eye" method.

The Course Angle Cards and Data Cards described in the following pages are not set forth as something to replace the Maneuvering Board and Course Indicator—they are merely useful diagrams constructed to furnish in convienient form the solution of the course problems common in battleship maneuvers. In this limited field they have been found more rapid than either the Course Indicator or ordinary use of the Mooring Board; they tell when to turn as well as how much to turn, and in the so-called "two course evolutions" give data not readily obtained otherwise.

There are two Course Angle Cards:

The Full Speed Course Angle Card (Fig. 1).
The Standard Speed Course Angle Card (Fig. 2).

These cards are described as diagrams etched on transparent celluloid. For trial, however, they could be printed on tough transparent paper.

The diagrams are constructed for battleships with the best turning and speed variation data available in the Navy Department. They have the advantage that each diagram may be modified to allow for the special tactical qualities of any ship.

In addition, there is a Data Card (Fig. 3), which may be printed in any convenient form and kept posted on the bridge.

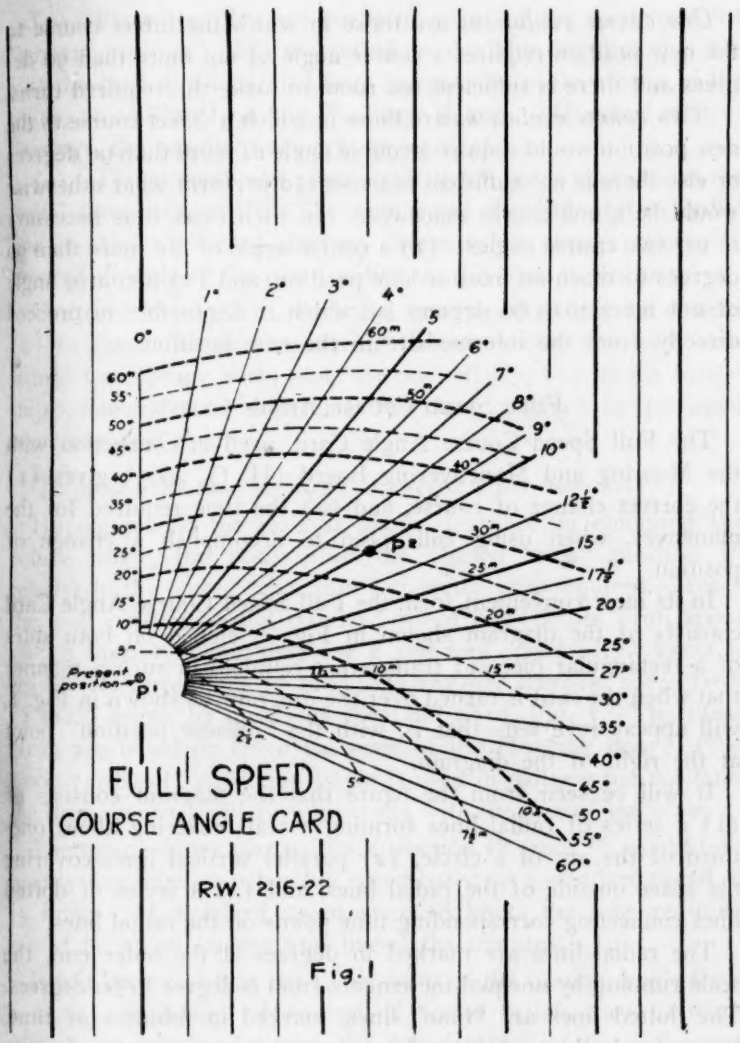


Fig. 1

In this description the *base course* is the course of the guide, assuming that the guide maintains a steady course during the maneuver.

The *course angle* as used in this article is the angle between the base course and the course of the unit maneuvering to attain a new position.

One course evolutions are those in which the direct course to the new position requires a course angle of not more than 90 degrees and there is sufficient sea room to make the required turns.

Two course evolutions are those in which a direct course to the new position would require a course angle of more than 90 degrees or else there is not sufficient sea room to perform what otherwise would be a one course maneuver. In such cases it is necessary to use two course angles: (1) a course angle of not more than 90 degrees to reach an intermediate position, and (2) a course angle of not more than 90 degrees by which it is possible to proceed directly from the intermediate to the new position.

FULL SPEED COURSE ANGLE CARD

The Full Speed Course Angle Card, used in connection with the Mooring and Maneuvering Board (H. O. 2665) gives (1) the correct change of course, and (2) the time required for the maneuver, when using full speed to accomplish a change of position.

In its most convenient form the Full Speed Course Angle Card consists of the diagram shown in Fig. 1, etched on both sides of a rectangular piece of transparent celluloid in such a manner that when the card is turned over the diagram, as shown in Fig. 1, will appear reversed—that is, with the "present position" point at the right of the diagram.

It will be seen from the figure that the diagram consists of (1) a series of radial lines forming a scale covering about one-third of the arc of a circle, (2) parallel vertical lines covering the space outside of the radial lines, and (3) a series of dotted lines connecting corresponding time points on the radial lines.

The radial lines are marked in degrees at the outer end, the scale running by unequal increments from 0 degree to 60 degrees. The dotted lines are "time" lines, marked in minutes of time, for a standard speed of 15 knots.

To obtain the correct change of course (course angle):

(1) If using true bearings, indicate the course of the guide by a line from the center of the Mooring Board. If using relative bearings, call the zero line of the Mooring Board the course of the guide.

(2) Plot on the Mooring Board the "present position" and the "new position" assuming the guide at the center of the diagram, and using the one-inch squares on the board as 1,000 yards.

(3) Place the "present position" point of the card over the "present position" (P^1) as plotted on the Mooring Board. Adjust the card so the parallel lines are parallel to the course of the guide, as indicated on the Mooring Board. (If using relative bearings, the parallel lines will be vertical.)

(4) The plotted "new position" will fall on or near one of the radial lines, say at P^2. The number at the end of this radial line is the number of degrees necessary to change course to proceed directly to the new position, in this case 10 degrees.

The time required to reach the new position may be desired (a) to check the plotting during the maneuver, (b) as a substitute for plotting when plots are not reliable, (c) by the battleship commander to determine how long a given or proposed maneuver will require.

To obtain the time required to complete the maneuver:

Having placed the card as above described in obtaining the course angle, the position of the plotted "new" position P^2 relative to the dotted "time lines" gives the time required to reach the new position if the standard speed is 15 knots (full speed 16-7/8 knots). This time for a *standard* speed of 15 knots is readily converted into the time for any other *standard* speed from 12 to 20 knots, by means of the Data Card, Fig. 3. The times given are based on the usual scale of the Mooring Board, 1″= 1,000 yards. If a different scale is used in plotting the positions the time required will vary inversely with the size of the scale.

The figure shows that to reach position P^2 from P^1 would take twenty-five minutes using full speed based on a standard speed of 15 knots. If standard speed were 18 knots the time required would be about twenty and five-sixths minutes.

It has been said that the above form of the Course Angle Card is most convenient. However, if found satisfactory to work entirely on relative bearing, the full diagram of the full speed course angle card (omitting the parallel lines) could be printed in red on, and concentric with the Mooring Board diagram. In this case the parallel rulers would be placed on the present and new positions, then moved to the center of the diagram, and the intersections of the rulers on the course angle scale would give the correct angle. The time would be obtained by drawing this

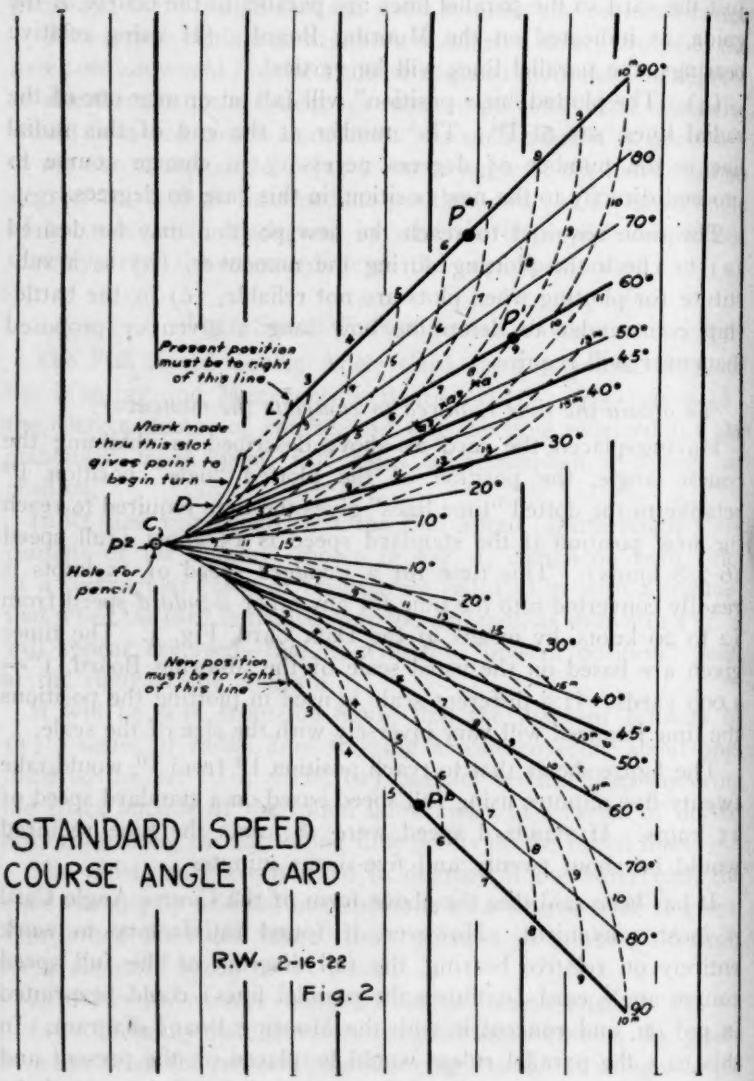

Present position must be to right of this line
Mark made thru this slot gives point to begin turn
Hole for pencil
New position must be to right of this line
STANDARD SPEED
COURSE ANGLE CARD
R.W. 2-16-22

Fig. 2.

line, and measuring on this line a distance from the center equal in length to the line joining the present and new positions.

STANDARD SPEED COURSE ANGLE CARD

The Standard Speed Course Angle Card is useful in both one course and two course standard speed evolutions.

ONE-COURSE EVOLUTIONS

In one-course evolutions it gives:

(1) The correct change of course (course angle) for proceeding directly from present position to new position using standard speed.

(2) If working on time—

(a) The correct time for beginning the turn back to the base course, reckoned from the beginning of the first turn.

(b) The time required to complete the maneuver.

(3) If plotting—

(a) The point at which to begin the final turn, if on the correct plotting line.

(b) The change of course required, in case the plots "run off" the correct plotting line.

(c) In conjunction with the data card, the change of speed which may be used in place of a small change of course, in case the plots "run off" the correct plotting line.

The Standard Speed Course Angle Card consists of the diagram shown in Fig. 2, etched on both sides of a rectangular piece of transparent celluloid, in such a manner that when the card is turned over the diagram as shown in Fig. 2 will appear reversed—that is, with the point "C" at the right of the diagram.

The vertical parallel lines are similar to those of the Full Speed Card.

"C" is a small hole and "D" a curved slot through which a pencil point can make a mark on the Mooring Board diagram.

The solid lines radiating from "C" are marked in degrees at their outer ends.

The dotted lines are "time" lines connecting corresponding time points on the radial lines. They are marked in minutes, for a standard speed of 15 knots.

The solid curved line "LC" indicates the minimum limits within which it is not practicable to perform the change of course indicated.

In one-course maneuvers, only the upper half of the diagram is used.

To find the correct change of course (course angle) for a one-course evolution:

(1) Plot the present and new positions on the Mooring Board (H. O. 2665) assuming the guide as at the center of the Mooring Board, and using the usual scale of 1" equals 1,000 yards; and indicate the course of the guide if using true bearings.

(2) Place "C" over the *new* position (P^2) using that side of the card which puts the radial lines of the diagram over the present position.

(3) Turn the card so that the parallel lines are parallel to the course of the guide as indicated on the Mooring Board (if using relative bearings course of guide will be zero, and these lines will be vertical).

(4) The present position (P^1) will fall on or near one of the lines radiating from "C". The number at the end of this line, interpolating if necessary, indicates the correct course angle. For positions P^1 and P^2 this would be 60°.

To find the correct time for beginning the turn back to the base course, reckoned from the beginning of the first turn:

Having placed the card for finding the course angle, the location of the present position relative to the dotted lines of the time scale gives the correct time at which to begin the turn back to the base course; for (P^1) this would be nine minutes. This time is for 15 knots, and for other speeds should be converted using the Data Card, Fig. 3. If standard speed is 18 knots the correct time would be about seven and one-half minutes.

To find the time required to complete the maneuver:

The time required to complete the maneuver is the "time to begin the turn" as found above, plus the time required in making

the final turn. For positions shown, at 15 knots the total time would be nine minutes plus two minutes, or eleven minutes, which at 12 knots would be thirteen and three-fourths minutes.

To find the point at which to begin the final turn, if on the correct plotting line:

Connect the present and new positions with a line drawn on the Mooring Board diagram. Successive plots should closely follow this line in approaching P^2, with the course angle given by the card. With the card in position as explained for finding the course angle, draw a curved line by running the pencil through slot D." The intersection of this line on the plotting line is the correct point to begin the turn.

To find the change of course required in case the plots "run off" the correct line:

Suppose that while using a course angle of 60° to approach P^2 from P^1, successive plots a^1, a^2, a^3 are obtained. As a^3 falls on the 50° line of the diagram, the correct course angle from that position is 50° instead of 60°. The proper change, therefore, is "ships right 10."

To find the change of speed which may be used in place of a small change of course, in case the plots "run off" the line:

Find the corrected course angle as explained in the previous paragraph, and consult the table of the Data Card. In the example given the ship was using standard speed and a course angle of 60°, whereas, if she maintained standard speed she should have changed to a course angle of 50°. The table of the Data Card shows that for a course angle of 60°, an increase of 2 knots corresponds to a change of course angle to 50°.

TWO-COURSE MANEUVERS

In two-course standard speed maneuvers, the Standard Speed Course Angle Card gives:

(1) The best combination of two-course angles to be used in reaching the new position, and the location of the correct "intermediate position" for that combination of course angles.

(2) If working on time—

(a) The correct time for beginning the second turn, reckoned from the beginning of the first turn.

(b) The correct time for beginning the final turn, reckoned from the beginning of the turn from the base course while in the intermediate position "C."

(c) The total time to perform the evolution.

(3) If plotting—

(a) The point at which to begin the second turn, when nearing the intermediate position.

(b) The point at which to begin the final turn on nearing the new position.

(c) The change of course required in case the plots "run off" the correct plotting line.

(d) In conjunction with the Data Card, the change of speed which may be used in place of a small change of course, in case the plots "run off" the correct plotting line.

In two-course maneuvers the whole diagram is used.

To find the best combination of two course angles:

(1) Plot the present and new positions on the Mooring Board, assuming the guide at the center of the Mooring Board, and indicate on the board the course of the guide (if using relative bearings course of guide is taken as zero).

(2) Use that side of the card which gives the first turn away from the guide if abeam or forward of beam of guide, or toward the guide if abaft the beam of the guide.

(3) Place the Course Angle Card over the Mooring Board with the present position P^a on that one of the upper lines, and the new position P^b on that one of the lower lines, which between them form the largest angle at "C." While doing this keep the parallel lines parallel to the course of the guide (if using relative bearings, these lines will be vertical).

(4) The numbers of degrees marked at the end of the radial lines on which the plotted positions fall, give course angles which, if used, will accomplish the required maneuver in the least possible time. For positions P^a and P^b as shown in the diagram the first course angle is 90° and the second course angle is 90°.

To find the correct time at which to begin the second turn and the final turn:

With the card in position for finding the course angles, the present position P^a on the upper 90° line falls at 6-1/2 on the time scale; this indicates that the second turn should be begun six and one-half minutes after beginning the first turn, and that when the ship has resumed the course of the guide, its plotted position will be at "C."

Similarly, the new position P^b falls at 5-1/2 in the lower 90° line. This indicates that the final turn should be begun five and one-half minutes after beginning the turn from the base course, while at the intermediate position "C."

To find the total time for the maneuver:

Add the time indicated on the upper line, the time indicated on the lower line, the time to turn through the first course angle and the time to turn through the second course angle. In the example given, the total time would be 6-1/2+5-1/2+2-1/2+2-1/2=17 minutes at 15 knots. This may be covered for other speeds by the Data Card.

In the above example the course angles found were those required to perform the maneuver in approximately the shortest time. It may happen in the case of units whose evolutions do not determine the total time for completing the change of formation, that it is preferable to avoid radical changes of course when near the new position, even at the expense of a little time. By moving the card, while keeping the parallel lines parallel to the course of the guide, any number of combinations of course angles, with the time required for each combination, may be obtained.

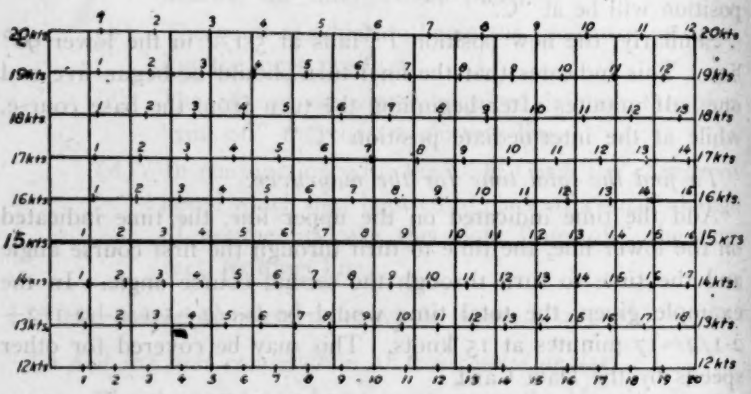
Use of the card when plotting in two-course maneuvers:

The upper half of the diagram of the card is used in plotting in the two-course maneuvers in the same manner as in one-course maneuvers. In plotting the approach to the intermediate position "C," the card is kept in the position for obtaining the course angle. To plot the approach from the intermediate position "C" to the final position, it is necessary only to turn the card over, and use the upper part of the diagram just as if the maneuver were merely a change from the intermediate to the final position.

DATA CARD

The Data Card is merely a printed card which contains data for use in connection with the course angle cards. It may be posted on the bridge, or merely kept at hand while using the course angle cards. It is shown in Fig. 3, and is largely self-explanatory.

DATA CARD



Scale for converting times at 15 kts to times at other speeds

Present Course Angle	Standard Speed Course Angles to which Small Changes of Speed are Equivalent				
	3kts less than Stand	2kts less than Stand	1kt less than Stand	1kt more than Stand	2kts more than Stand
90°	100°	97°	93°	87°	85°
80°	92°	88°	84°	76°	73°
70°	85°	80°	75°	66°	62°
60°	78°	72°	66°	55°	50°
50°	72°	64°	57°	44°	38°
45°	68°	60°	52°	39°	32°
40°	65°	56°	48°	33°	26°
30°		53°	41°	21°	

Times for turns at 15 knots	
Turn	Time
90°	2m30s
80°	2m20s
70°	2m10s
60°	2m
50°	1m50s
45°	1m45s
40°	1m40s
30°	1m30s
20°	1m10s
10°	0m50s

Table for adjusting approach to new position by change of speed

RW. 2-16-22

Fig. 3

The time scale is given for times up to sixteen minutes, but may be used for longer intervals of time. Thus to convert twenty-four minutes at 15 knots, to time at 20 knots; the scale shows twelve minutes at 15 knots, corresponds to nine minutes at 20 knots—therefore, twenty-four minutes at 15 knots corresponds to eighteen minutes at 20 knots.

The table for small changes of speed is based on a standard speed of 15 knots, and some allowance is made for delay in ships picking up or losing speed. It is, therefore, only approximate. The table giving the time to make various turns is approximate, and would of course be more accurately obtained on each ship.

CONSTRUCTION OF COURSE ANGLE DIAGRAMS

Having described the use of the Course Angle Cards, it may be of interest to examine the method of constructing the diagrams.

The construction of the Full Speed Card is comparatively simple. The several radial lines of the diagrams are merely the lines of plotted relative positions which result from a ship at the center (marked "present position") taking full speed and changing course the angle marked at the outer end of each line. The dotted time lines are obtained by plotting on the mooring board. Allowance is made for time required for ships to pick up speed.

The construction of the standard speed card is somewhat more complicated.

If a ship turned instantaneously and without loss of speed, the following rule would govern:

"If a ship in formation change course any angle, maintaining the same speed as the guide, the plotted positions of that ship, relative to the guide, will follow a straight line whose inclination to the "beam line" of the guide is one-half the change of course."

This rule may be checked by the Mooring Board or proved mathematically.

Referring to Fig. 4—if a ship at any position, say "P," with same course and speed as the guide, changed course instantaneously 90° to the right without loss of speed, its successive positions relative to the guide would plot along the line "PX," the

angle "XPK" being half of 90°, or 45°. Similarly, if the change of course were 60°, the successive relative positions would plot along the line "PY," the angle "YPK" being half of 60°, or 30°. This is the basis for the construction of the lower half of the standard speed card.

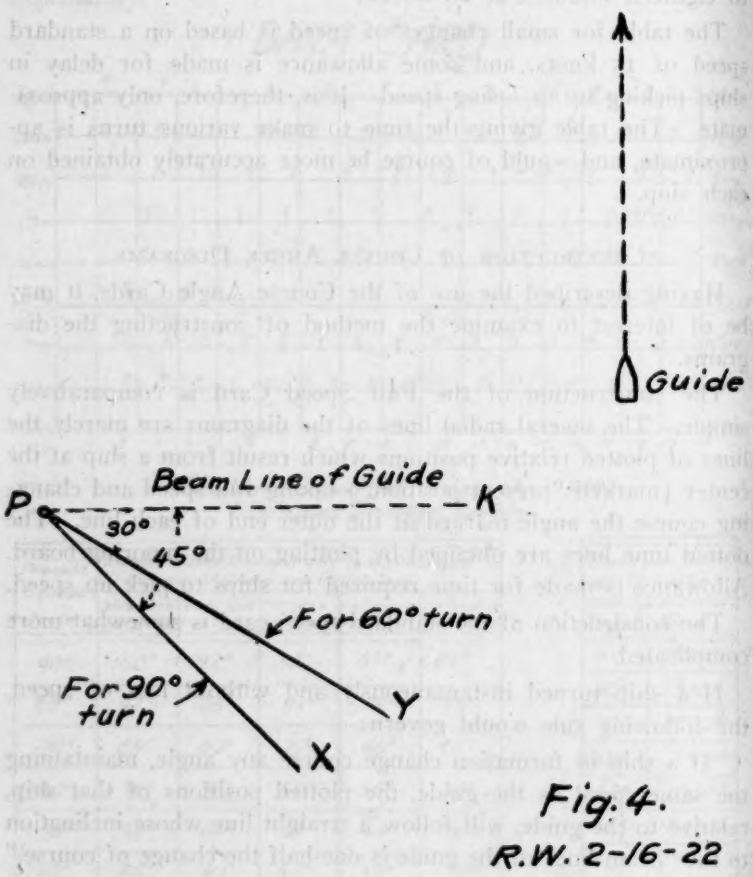


Fig. 4.
R.W. 2-16-22

Now considering Fig. 5—If it is desired to reach a new position relative to the guide, say at P^2, using standard speed and a course angle of 90° away from the guide, it is apparent that the present position of the ship must be somewhere on the line PP^2, which makes an angle of 45° with beam line of the guide

BP^2. If the course angle were to be 60°, the present position would have to be on the line QP^2 (angle QP^2B being 30°). If the course angle were to be 30°, the position would have to be on the line RP^2 (angle RP^2B being 15°). This is the basis for the construction of the upper half of the standard speed card.

But ships do not turn instantaneously, and they do suffer a temporary loss of speed as the result of a turn. We will examine the extreme case of a 90° turn, it being understood that

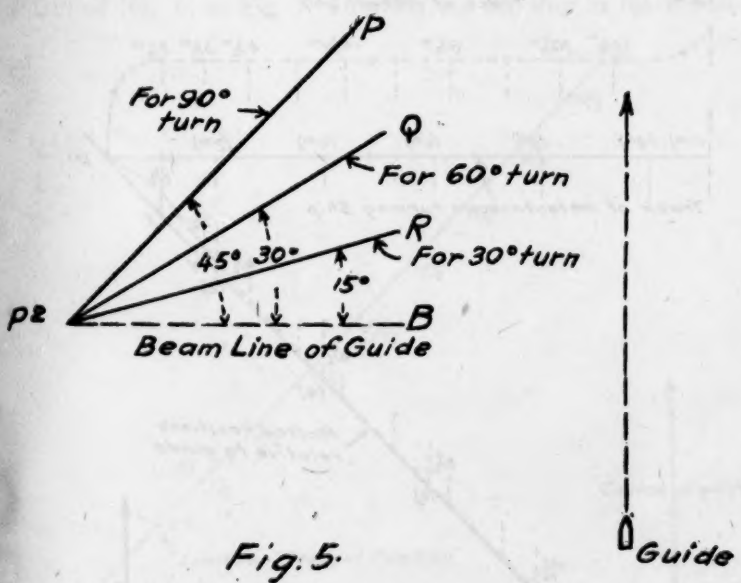


Fig. 5.

R.W. 2-16-22

the same process has been followed in the construction of the diagram for other angles of turn.

Fig. 6 shows the tracks and plotted relative positions of an actual ship and an "instantaneous turn" ship, which, from a position P^1, make a turn of 90° left, and later a turn of 90° right with a view of attaining a new relative position P^2. The dotted line represents the actual ship, the solid line the "instantaneous ship." The figure shows that when the ship turns 90° (with tactical diameter of 1,000 yards) its plotted positions at the end of

each turn (points 2½ and 14) are ahead of the 45° plotting line P^1P^2. But at the end of a 90° turn a battleship has lost about thirty per cent of its speed. This shows in the figure between points 2-1/2 and 4-1/2 when the dotted line drops back toward the 45° line; also between points 14 and 16. On completion of the

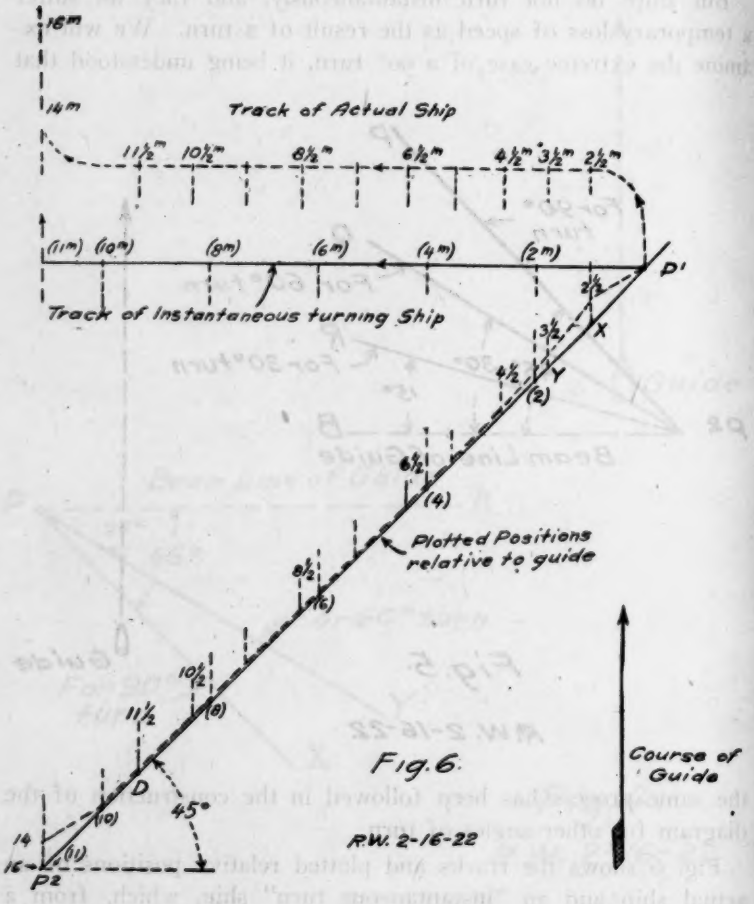


Fig. 6.

second 90° turn the relative position of the actual ship plots at 14, but before the ship regains its speed, the plot of the relative position will drop back to point 16. In other words, the extremities of the line of plotted positions for the actual ship approximately coincide with those of the "instantaneous" ship,

and the rule of halving the angle of change of course may be used for the diagram of the course angle card. However, the "time points" do not coincide, and any time scale for the course angle card must be based on the time intervals of the actual ship as found by plotting.

Now for the purposes of the course angle card, it is desirable to know—not so much where the ship's position will plot at a certain time—as how long after starting the first turn, the second turn should be begun. Suppose we reproduce the solid line P^2DP^1 of Fig. 6, as Fig. 7. In order for the ship to reach posi-

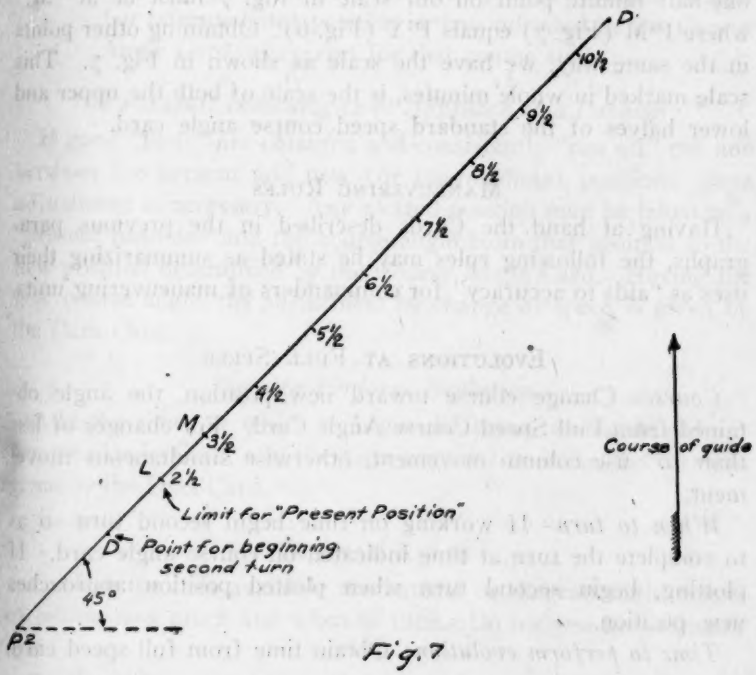


Fig. 7

RW 2-16-22

tion P^2 it must begin the *second* turn when at position "D." In order to complete the *first* 90° turn before reaching "D," the "present" position must be as far from point "D" as the plotted position will move toward "D" while the ship is making the first 90° turn. This distance is "DL" (Fig. 7) which is equal to P^1X of Fig. 6. But it takes two and one-half minutes to turn 90°,

therefore point "L" is the two and one-half minute point on the scale we are constructing. In other words if a ship at "L" turn 90° to the left, and at two and one-half minutes later (on completing the turn) begins a 90° turn to the right, the ship will reach position P^2 when it has picked up its speed and is on the course of the guide. It will be seen that "L" marks the position nearest P^2 from which this maneuver can be performed.

Now Fig. 6 shows that in three and one-half minutes from beginning the first turn, the plotted position moves a distance which projects on line P^1P^2, as P^1Y. Therefore, the three and one-half minute point on our scale in Fig. 7 must be at "M," where P^2M (Fig. 7) equals P^1Y (Fig. 6). Obtaining other points in the same way, we have the scale as shown in Fig. 7. This scale marked in whole minutes, is the scale of both the upper and lower halves of the standard speed course angle card.

MANEUVERING RULES

Having at hand the Cards described in the previous paragraphs, the following rules may be stated as summarizing their uses as "aids to accuracy" for commanders of maneuvering units.

EVOLUTIONS AT FULL SPEED

Course—Change course toward new position, the angle obtained from Full Speed Course Angle Card. For changes of less than 10° use column movement, otherwise simultaneous movement.

When to turn—If working on time begin second turn so as to complete the turn at time indicated on course angle card. If plotting, begin second turn when plotted position approaches new position.

Time to perform evolution: Obtain time from full speed card.

EVOLUTIONS AT STANDARD SPEED

Whether a one-course or two-course evolutions, and the appropriate course angle or angles.

The Course Angle Card gives this information. For the convenience of unit commanders in making signals for the first turn, it can be placed in tabular form.

Direction of First Turn

If present position is—

(a) Forward of guide's beam, first turn is "out."

(b) Abeam of guide, first turn is "out," except in forming column, when it is "in."

(c) Abaft beam of guide first turn is "in."

When and Where to Execute Turns

(a) If working on "time," execute turns at time indicated by Course Angle Card.

(b) If plotting, execute turns when plotted distance to new (or intermediate) position is that indicated by the Course Angle Card, as correct for that course angle.

To Adjust Inaccuracies in Approach to a Position

If good "plots" are obtained and consistently "run off" the line between the present and new (or intermediate) positions, some adjustment is necessary. Any plotted position may be taken as a "present position" and the course angle from that position to the new position determined by the Course Angle Card. Having the new course angle, the adjustment by change of speed is given by the Data Card.

Time to Perform Evolution

Add the times at which to begin the turns, as obtained from Course Angle Card, and the time required to make the turns as given by the Data Card.

GENERAL RULES

1. Use the best available mechanical or diagrammatic means of telling how much and when to turn. Do not use the seaman's eye.

2. Turn too soon rather than too late.

3. While maneuvering, keep ahead rather than behind your line of plotted correct positions.

4. Use both plotting method and time method whenever possible, checking each with the other.

DISCUSSION

A Fighting Leader for the Fleet

(See Page 561, Whole No. 230)

Captain J. K. Taussig, U. S. Navy.—When my paper on "An Administrative Flagship for the United States Fleet" was written, I had not seen Lieutenant Commander Turner's article on "A Fighting Leader for the Fleet," published in the April Proceedings. I am sorry for this, as it would have then given me the opportunity to refute some of the statements and arguments which Mr. Turner advances in his discussion.

It seems to me that throughout Mr. Turner's paper, while he is dealing with very big things, all his arguments are based on smaller things, that is, much smaller than the present-day conditions warrant. His conclusions seem first to have been reached, and the arguments to justify these conclusions made afterwards.

Early in his paper are the following statements:

1. The tradition of the sea is the fighting leader commanding the fleet from a fighting ship and exercising a personal control whether of strategical operations or tactical movements in battle that has in the case of shore forces been delegated to subordinates by the general in command.
2. Successful war at sea has in the past been waged by seamen with seamen's methods; in the future seamanlike methods will gain like results.

And in referring to Staff methods:

3. Not content with the British system, since, in the only sea battle of first importance, it (or something) failed to produce satisfactory results even with overwhelming forces, we attempt to adapt the devices of the soldier to the solution of the problems of the sailor.

It is evident from the above quotations that the author is appealing to something very indefinite in the sea atmosphere as an argument against profiting by the lessons learned by land forces. The truth of the matter is, we in the navy have a great deal to learn from the army in regard to organization. This is because the army has been used for many years to deal with numbers, while it is only in recent years that the navy has grown to respectable size.

It was not so very many years ago when the army followed the tradition of always having the commander-in-chief at the front, leading his troops into battle. When armies got too big for this they stopped that foolishness and put the leader where he could best control; which was not a place where he would likely be the first man killed. Now that our fleet has reached a size where it is impossible for the commander-in-chief to personally control the individual ships, we had better profit by the lessons to be learned from the army.

It is true "successful war at sea has in the past been waged with seamen's methods." But let us not forget that the seamen of today are very different from the seamen of the past. And what is of still more importance let us keep in mind that with the change in character of ships, and size of fleets, that seamen's methods have very materially changed. We must advance our organization and administration in keeping with the advancement in seamen's methods.

In referring to the British at Jutland he speaks of the failure of the staff system ("or something") as the cause of unsatisfactory results. It was not the fault of the British staff system. The "something" which prevented a British victory on that day was twofold. One was the defensive tactics employed, and the other was the lack of co-ordination and co-operation of the forces of the British fleet due to the fact that the commander-in-chief was in immediate command of the battleship. The lesson learned in this battle (the only one ever fought where fleets on a large scale were engaged) surely should take precedence over the traditions and experiences of the past wherein only comparatively small forces composed the fleets.

We must advance in organization as well as in other matters. And the proper organization of a modern fleet calls for the commander-in-chief to be separated from the immediate command of any one of the forces that compose that fleet. If we do not do this the next *great* sea fight will be another Jutland. The various forces will not be properly co-ordinated, and effective co-operation will be impracticable.

To carry out the argument that the commander-in-chief must take immediate command of the battleships because they exert the most fighting power, we might as well argue that the captain of a battleship should take immediate charge of the turrets of the ship, and the President of the United States should take immediate charge of the war and navy departments.

There can be no objection to the commander-in-chief being on a fighting ship, and in the absence of battle cruisers it may be that a battleship is a better place for him than a scout cruiser or some other type of ship. But whatever kind of ship he is on, he must not be in immediate command of the battleships nor must he of necessity be physically attached to them. This would cramp his style entirely too much. He must be free to take whatever position he pleases.

The position he would take would not necessarily be *back* of the fighting line. It might be in the fighting line; in advance or in the rear of the fighting line, within gun range; or it might be entirely out of gun range on one of the flanks. It will be that position which will enable him best to learn through communications, his own observations, and the observations of his staff reduced to a plotting board, what is actually going on.

Mr. Turner states: "The battleship force is the fleet; . . ." This statement is so far from fact, so misleading to the layman, that it must not be allowed to pass unnoticed. It is just such statements as this that have prevented us from obtaining a balanced fleet. It is this stand taken

by some officers that has resulted in our not having any battle cruisers, few light cruisers, and no destroyer leaders. It is the stand which prevented an adequate number of destroyers until the submarine forced them on us. It is this stand that is now preventing a proper development of air craft.

The fleet is not any one of the elements that compose it. While the battleships are the backbone of the fleet, still there should not be any such thing as a battleship force in a modern up-to-date organization. This is recognized by the Navy Department. After making a thorough study of the Battle of Jutland, and a careful estimate of the situation as it at present relates to our sea-going forces, an organization of the United States Fleet has been adopted. There is no battleship force in this organization. Instead there are the battle force, scout force, base force, control force. Each of these forces is composed of a combination of different kinds of ships in accord with their war time functions. *It is these forces in toto which are the fleet.* And for their proper administration and command there should be a ship, independent of all these forces, on which the commander-in-chief should be stationed. There is too much for the commander-in-chief to do with respect to the entire fleet, to saddle him with the immediate command of one of its parts.

Mr. Turner states that "The battleship force should be handled as frequently as possible—every time it gets underway as a force—by the man who is to handle it in action." Granting that by "battleship force" he means the battleships in the firing line, it is a perfectly logical statement. But why should the commander-in-chief have to do this? Have we not other flag officers capable of commanding battleships and who of course would habitually command them before and during battle, in fact every time they get underway? Are we not far enough advanced for the commander-in-chief to trust and rely on the commander of the battleships just as he trusts and relies on the commanders of the cruisers, the destroyers, the submarines? The argument Mr. Turner makes about the Battle of Jutland disproves all his own statements. He says in speaking of the British: "Success eluded them not because of defective ships, faulty organization, poor gunnery, or lack of information, but because of ineffectual handling of the battleships."

Faulty organization and lack of accurate information certainly did have something to do with the lack of British success. But both of these were intimately connected with the chief cause of failure, that is "the ineffectual handling of the battleships." The battleships were ineffectually handled partly because the commander-in-chief who had his hands more than full in the endeavor to co-ordinate the large number of elements of the fleet, was also attempting to take immediate command of the battleships. The lack of co-ordination between the various forces that composed the British fleet is what caused the failure of the British to beat the Germans. Their co-ordination and co-operation was lacking because the British commander-in-chief was so intimately connected with the battleships that his chief duty was neglected.

Mr. Turner's closing sentence is: "The fleet must, in peace or in war, be directed by a fighting leader in a fighting ship.". He is undoubtedly right about the statement that the fleet must at all times be directed by a fighting leader. That it would be desirable for him to be on a fighting ship at all times is not necessarily so. Not unless the fighting ship is such that his other functions such as planning, and administering can be carried out to better advantage, than on some other class of ship. Certainly this can not be done now.

We must remember that tactics are only the culmination of organization, administration, planning, strategy, and logistics. Certainly due consideration must be given to all these things. We must not limit ourselves to only the tactical viewpoint.

In regard to the "two flagship" system, this, of course, is a makeshift because there is no suitable ship extant for service as both an administrative ship and a tactical ship. It would be wise if we built such a ship. It would be worth more to us than any single unit which the limitation of armament agreement permits us to build. But there is no immediate chance of this. In the mean time it is far better for us to go half way right by having both an administrative flagship and a tactical flagship, than it is to stay all the way wrong by not having either.

To tie down the commander-in-chief to one of the elements of his command is wrong in theory, it is wrong in principle, and in the only really great modern battle, it has been proved to be wrong in practice.

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

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authors free of charge. Authors are requested to notify the secretary and treasurer of the number of additional reprints desired when the article is submitted.

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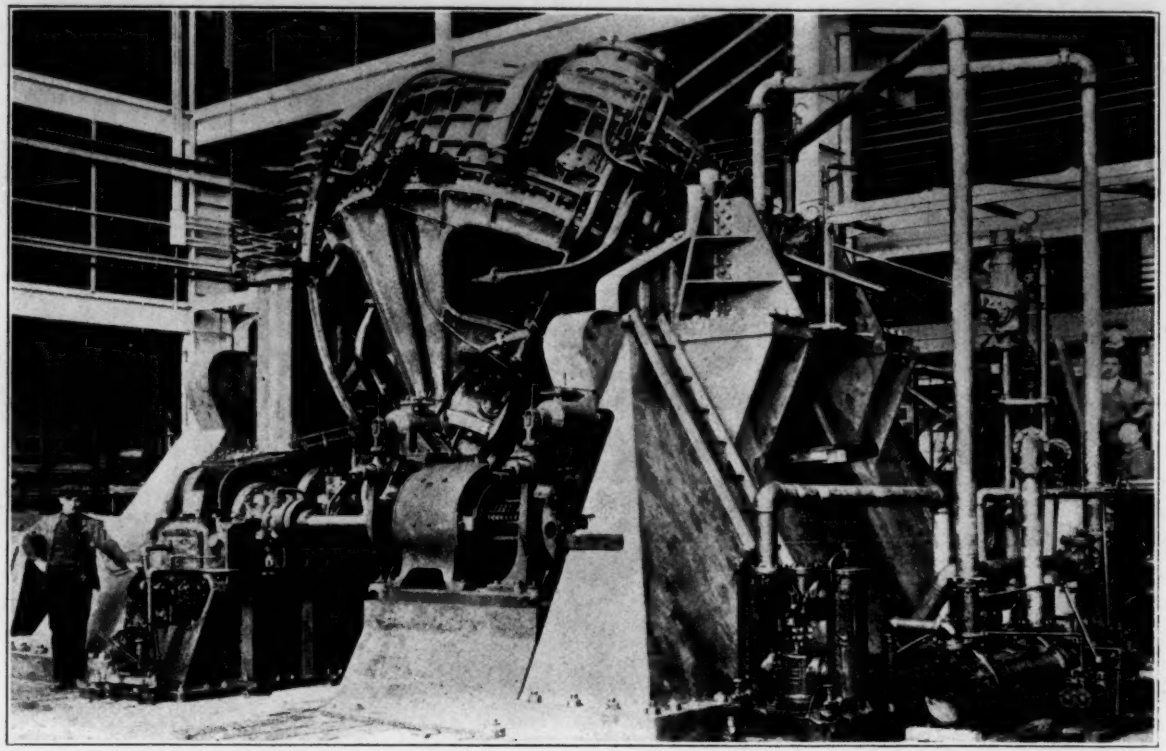

SPERRY GYRO-STABILIZER FOR "HAWKEYE STATE"—VIEW SHOWING STABILIZER IN PRECESSIONAL POSITION AT THE WESTINGHOUSE WORKS, PHILADELPHIA.

This is the largest stabilizer ever built, and the first to be installed in a passenger ship.—*The Marine Engineer and Naval Architect*, June, 1922.

PROFESSIONAL NOTES

PREPARED BY

LIEUTENANT COMMANDER F. W. ROCKWELL, U. S. NAVY

GENERAL ARRANGEMENT

VESSELS BUILDING NAVAL POLICY MATÉRIEL PERSONNEL MERCHANT MARINE	Great Britain	1397
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GREAT BRITAIN

AN EMPIRE NAVY.—Last week we referred in this column to the somewhat extraordinary fact that while we are whittling away our naval strength in this country the Dominions appear to regard the present moment as timely for reducing their own fleets. In connection with this important subject the naval correspondent of the *Morning Post* makes a suggestion which deserves the utmost consideration. Briefly surveying the work and results of the various Imperial Conferences which were held before the war, and which led to the institution of Dominion navies, he asks whether the time has not come for reopening the questions that were then settled. His view is, and it is that of many other people, that after the reductions which the Dominions are making there will be so little left that it becomes a question whether the retention of so little is worth while. Would it not be better, he suggests, to pool resources and establish a central striking force of maximum mobility? Certainly it is worth consideration by the Dominions whether on some such plan they would not get a more effective return for their money than by spending it on skeleton navies with little or no power of expansion behind them. The Prime Minister said the other day that "he had always been conscious that the ultimate support of peace and freedom must be force—force guided by right, but still force." Assuredly Mr. Lloyd George must be aware that the force he must mainly rely upon for the purpose he talks about must be the British navy. The Premiers of the self-governing Dominions must be equally aware of this fact. Lord Northcliffe pointed out to them very clearly and candidly what the shelter of the British fleet meant to them. It seems, therefore, most suitable and appropriate at the present moment to attempt reconsideration of the whole question of Imperial naval defense, and for that purpose to call together another Con-

Engineer and Naval Architect, June, 1922.

ference in London to discuss the matter.—*Army, Navy, and Air Force Gazette*, 3 June, 1922.

BRITISH SEAPLANE FLOATING DOCK.—It is announced that the seaplane floating dock, which has been under construction at Sheerness Dockyard to the orders of the Air Ministry, has now been delivered as ready for service. For the present, the craft has been berthed in the Medway, near Port Victoria. The dock, which has an over-all length of 143 ft. and a lifting capacity of 200 tons, will accommodate two large modern seaplanes, has thirteen buoyancy compartments, each flooded direct from the sea and emptied by blowing with compressed air. The power for the air compressors is supplied by two oil-driven dynamos, which also provide the current for lighting and power for workshop machinery, capstans, winches and pumps. An interesting feature is the supply of petrol to seaplanes from a large storage tank on the deck by means of the Bywater hydraulic system.—*Flight*.

FUEL FOR THE FLEET.—A wide range of subjects was covered by last week's debate on the Navy Votes for works, wages, etc. In dealing with the question of oil-fuel storage the Civil Lord of the Admiralty said, very rightly, that provision of oil supplies was vital to the fleet. The Admiralty, not without grave misgiving, asked for a sum of money that would permit of the creation at various strategic points of oil reserves which represented the absolute minimum for future requirements, and if these were not forthcoming the fleet would be deprived of its mobility, without which it would be absolutely useless for any purpose whatever. The provision of such supplies is, therefore, of paramount importance, and the limited sum to be appropriated this year is only the first instalment of a much larger amount that will have to be spent sooner or later. Several speakers in the debate criticised the erection of "gasometer oil-tanks" on the coast, where they would offer conspicuous targets to hostile aircraft or long-range guns. This method is certainly open to objection, but to put all the tanks underground would involve a tremendous expenditure which the country is in no condition to stand.

The Admiralty evidently believe that it is better to have exposed tanks than none at all, for there is not the slightest doubt that a request for the millions of money needed to provide underground tanks of the necessary capacity at naval stations at home and abroad would be summarily rejected. Incidentally the debate brought from Lieut-Comdr. Kenworthy a presumably authentic explanation of the so-called "Mystery Towers," which, it appears, were to have been sunk at selected points in the Dover Strait to frustrate the passage of enemy submarines. This is the theory which has always found the most general acceptance, though some imaginative people thought the towers were intended to be towed into the German rivers for the purpose of sealing up the High Sea Fleet. The tower at Shoreham has proved an unmitigated nuisance since it was dumped there, and in now deciding to spend £17,000 on demolishing it the Admiralty have probably taken the wisest course.—*Naval and Military Record*, 31 May, 1922.

THE MYSTERY TOWERS AGAIN.—Further to the note in the *Journal* of April 7, we have now to record a few additional facts concerning the so-called mystery towers, gleaned from the remarks made in the House of Commons on Tuesday in the course of the consideration of the Naval Estimates. It appears that at the date of the Armistice there were fourteen "towers" under construction. Since the Armistice a sum of about a million pounds has been spent on them, partly for the purpose

of completing the two which had reached an advanced stage at Shoreham, but principally on the demolition of the other twelve. One of the completed towers is now in use taking the place of the old Nab Lightship and for certain undefined experimental purposes. A sum of £17,000 has just been voted for the demolition of the second completed tower, which still remains in Shoreham Harbour. Altogether the sum of £1,180,000 represents the bill which the country has to meet in connection with the construction and demolition of these towers, the precise function of which has never been officially disclosed.—*The Engineer,* 26 May, 1922.

POTENTIAL MILITARY MAN-POWER OF THE BRITISH EMPIRE.—It will be remembered that in our issue of December, 1921, we published an article on the leading armies of the world, showing the strength of the various active armies, their strength in trained reserves, and the total available man-power of military age. The table for available military man-power credited the United States with 15,700,000, Great Britain with 25,000,00, and France, Italy, Germany and Japan with from 5,000,000 to 6,500,000 men. Since the publication of that article we have been in receipt of correspondence calling in question the large figure of 25,000,000 military man-power credited to Great Britain, and in response to our application for the figures as estimated by competent authorities of the British War Office, we have received the data given below.

The total male, white, population of the British Empire is estimated at 30,000,000, and of these we are informed that 30 per cent, or about 9,000,000 are males of military age, fit for military duty.

It will be evident to anyone who read our article, that the high figure of 25,000,000 was due chiefly to a liberal estimate of the military man-power which would be derived from the teeming millions of India, and in the table which we gave it is stated in a footnote that in the estimate 5 per cent of the total population of India was estimated as being available. The World War Office advises us, however, that as regards colored man-power, it considers that reliance cannot be placed on a larger figure than 3,000,000, as representing the number of colored males fit for use as fighting troops.

The numbers who might be regarded as man-power from the point of view of labor, or ancillary services, depend upon the exigencies of the moment. If the figure of 1,000,000 be taken as being the maximum requirement relative to the 9,000,000 white and 3,000,000 colored males, as mentioned above, this would give the grand total of man-power available as 13,000,000.

It must be remembered, moreover, that although the men of some of the tribes in India are noted for their stamina, courage, and amenability to discipline, and have proved their worth in various branches of the military service, the great mass of the Indian population has neither the physique nor other qualities that are necessary to the makeup of a soldier.—*Scientific American,* July, 1922.

PANIC EXPENDITURE.—To those who recognize the symptoms it must be clear that unless some glaring scandal proves a red herring this country must expect before long to find itself in the throes of a scare. Readers of this journal will not be surprised, for, as is well known, history repeats itself, and scares and panics invariably follow the wholesale reductions of the armed and disciplined forces after a successful war. It has been shown here how after the peace of 1815 scares followed one another in quick succession owing to the cutting down of the navy. It was always some new invention or some novel method of warfare in which it was supposed that other nations were advancing quicker than ourselves which started the trouble. Sometimes there was a real and genuine cause

for alarm, but in nearly every case panic expenditure proved extravagant and wasteful.

The danger to which we are assumed now to be exposed arises from a belief that we have an inadequate air force. And the panacea proposed is to cut down the army and the navy to a still greater extent and spend the money thus saved on subsidising civil aviation. Of course, the air force is inadequate if there is any real danger of an attack. We are, as it is said, at the mercy of the first hostile power that launches an attack from the sky. But it may also be contended that as a result of recent reductions the navy and the army are inadequate, too, and would succumb to an attack by land and sea from a superior enemy power. It is a little difficult, however, even to imagine which is to be the hostile power in either case. And, again, whereas in all the earlier scares and panics it has been the armed and disciplined forces of the country upon which expenditure was demanded, in this case it is something entirely different and novel. We have no doubt that civil aviation is an excellent thing to encourage, and we do not question the motives of those who wish it should be supported from the public funds. But the new director of civil aviation has promised a real policy, and until this is proved to be disappointing it is just as well that the country's confidence should not be shaken by phrases such as "the dykes have been swept away" or "the navy can no longer safe-guard the homes of the British people." —*Army, Navy, and Air Force Gazette,* 17 June, 1922.

FRANCE

ARMAMENT OF THE CRUISERS OF THE BOUVET CLASS: THE ANTIDOTE TO AERIAL BOMBARDMENT: THE NAVAL ACTIVITY IN THE CHANNEL: FRENCH VERSUS BRITISH AVIATION METHODS.—The distribution of the armament on board is a determining element of fighting efficiency to which the French were the first to devote attention, as a comparison will show between the end-on cruisers designed by Ingenieur-General de Bussy (Depuy de Lôme, Descartes, etc., 1889-92) and the homogeneous series of broadside cruisers by Sir William White. Since then the British have beaten the French so far as military utilization of armament is concerned with the ships of the dreadnought era. The actual ambition of the Paris Section Technique is to regain the lead; hence the controversy in expert circles merits of axial gun batteries, that provide the maximum of arc and command of fire, and of side turrets in échelons that give a distinct advantage in the case of end-on contests. If the cruiser actions of the war are re-fought it will be found that superiority belongs to the turret disposition, as in the Jaurréguiberry and in the new Bouvets.

France suffered more from aerial attacks than any other belligerent nation, and, as a consequence, she devoted special attention to anti-aerial defence, realizing more in that branch of the war preparation than any other power. As recalled by Sir Percy Scott, there were French ideas and French guns that first defended London against aerial pirates in 1915. Since then substantial progress has been made, scientists and officers having kept in close co-operation, under the guidance of General Ferrié, head of the Army Anti-Aerial Defence Department, with a view to finding a satisfactory solution to a defensive problem that is felt to be vital for the security of France; and it is vital also to England, the Boches having, since the Rapallo Treaty, the means of acquiring anew the aerial supremacy. The little that has been rendered public testifies to French ingenuity and scientific attainments, and gives ground for the belief that the Republic is, with the possible exception of the United States, better prepared than any other power for the purposes either of aerial offense or defence.

The experience of the war showed that the "defense directe" of a city against bombardment aviation groups, that is, by means of counter aerial squadrons, is an operation very difficult to successfully carry out, and for two reasons: (1) the keeping in the air of permanent patrols ever waiting for enemy attacks has proved impracticable; thus, out of 45 avions detailed to the active defence of Paris, it was only possible to have five at all times in the air, and they only represented an illusory protection against the numerous squadrons which the enemy launched against the French capital. (2) As Commandant Ortlieb has shown *(L'Aéronautique*, Masson, Editeur), it takes nearly an hour for a defence squadron to be "alerted" and in a position to fight at sufficient altitude; which means that no direct defence can be opposed to unexpected attacks. The heavily-loaded Boche bombardment Gothas, that flew at a rate of some 70 miles per hour, delivered their worst night attacks on Paris when the German front was within 60 miles of the great metropolis (1918), and the Paris defence squadrons could not be warned in time of the impending onslaught. This means, also, that ports militaires and great cities situated, as London is, within 60 miles from the sea, could not be effectively defended by counter-aerial attacks against sudden aggression coming from the sea border, a truth which piratical Zeppelin raids partly demonstrated.

Therefore for such vulnerable centres as London and most naval bases, safety is to be sought in efficient mobile artillery barrages, consisting of successive screens of mitrailleuses, quick-firing and special guns both disposed in fixed batteries and on motor-trucks, and directed by an up-to-date detecting service. Terrific storms of bursting shells and thunder-like detonations, and incredible waste of ammunition greeted the first coming of the Gotha bombardment machines over Paris in the spring of 1918, but soon the French power of reaction in the face of danger and of improvisation was made to tell, and on the night of September 15-16, 1918, although the enemy employed 483 planes in an ultimate effort, only 37 could actually reach Paris, and 13 machines were brought down by French anti-aerial guns: and had the war gone on much longer it would have witnessed a tremendous execution of Boche bombardment craft. The secret (at least the initial part) of these gratifying results is revealed in a valuable booklet by Captain Baillaud (just published by Berger-Levrault, Rue des Beaux-Arts, Paris), that gives technical accounts of the various appliances and devices employed to locate with unerring accuracy fast traveling enemy machines and promptly to submit them to the blinding glares of converging searchlights and to the tender mercies of hurricanes of gas shells. Boche aviators, though brave and well-trained, strongly objected to these Gallic innovations, and, in October, 1918, they could not get over their dislike for night trips over the Gay City, and they sighed for the efficient armouring and silencing of motors, alone capable of minimizing the danger from the French "paraboloïde" listeners, "altitraceurs," and special projectors and fire control devices by Commandant Bochet.

Remarkable training activity is being displayed by the seagoing "Division de la Manche" under Rear-Admiral Lequerré, who has his flag on the 18,000-ton *Voltaire* and is ever at sea, with attending destroyers, submarines, and seaplanes, trying to do justice to a crowded time-table, seeing to his specialists keeping proficient with gun and torpedo and with the new modes of signalling, experimenting with new tactical devices based on a profuse employment of mines, long-range torpedoes, armoured torpedo-planes, and camouflaged gas clouds. Startling developments, both for attack and defence, are to be expected from the wholesale use of artificial clouds of varying density, colours, and poisonous propensities, the effect of which will be to considerably minimize the advantage of mere numerical ballistic superiority. On paper the French fleet has dwindled

to insignificance. It is the ambition of French naval men to make it a very ready force, as efficient as ceaseless scientific progress permits it to become, and alive with the old traditional spirit that would suffer, however despairing the circumstances, no Scapa Flow à la Boche.

Previous to 1914 the Lapeyrère Armée Navale prepared "la bataille navale" on the high sea in the good old human and loyal Suffren-Nelson style. To-day the war has altogether changed the problem: artillery contests on the high sea represent a thing of the past for French officers, whom their present numerical inferiority, and also their deep sense of wrong at the Washington trick, have converted to the worship of submarine and aerial arguments, and, in Admiral Lequerré's mind, the absorbing question is: How to meet and lure into destruction superior enemy forces; how to utilize to the utmost the resources of chemical and aerial warfare. It will be admitted that a fighting brain confronted with the preparation for action against great odds, will do more, and produce a greater effort of imagination, than is assured of having an easy superiority over any likely opponent. It is for reasons of this sort that the Channel fleet, though very inferior in material, is considered to be in advance of the Toulon force in some branches of training.

In the aerial, as in the naval, field of war preparation France may be said to think tactically, whilst Great Britain thinks strategically and in a spirit of offensive. Whereas Britain is concerned with long-distance flights and spares no effort to keep the whole globe within the radius of action of her giant flying machines and of her dogged aviators, France is centering her best attention on perfecting the military machine, the aviation de combat. The interesting aerial demonstrations now taking place at Le Bourget, near Paris, testify to the marvellous efficiency and daring of the pick of Gallic aviators, who have ever their eyes on the eastern frontier and are better prepared than all rivals for those aerial duels that gave glory to Guynemer, Fonck, and so many other "as de l'air," and are naturally the dream of every budding aviator. Speed, handiness, and aptitude to climb are the qualities that tell in air contests, and the performances accomplished point to steady progress, this being the result of co-operation between flying experts and designers. The misfortune is that greater financial and industrial resources are being employed in Bocheland towards a similar end.—*The Naval and Military Record*, 7 June, 1922.

THE COMING BOCHE REVANCHE AND THE NEED OF A STRONG FRENCH NAVY: AMMUNITION TESTS: IS THE AERIAL FORCE READY FOR WAR? BELATED DESTROYER: THE TRICOLOUR IN THE PACIFIC.—The Bocho-Bolshevist alliance, signed at Rapallo, is giving food for thought to French experts who, without wasting time in useless recriminations, are facing the new situation and getting themselves ready for the now unavoidable storm. Service journals, and especially the *Revue Militaire Générale* (Berger-Levrault, Editeurs), are discussing at length the various aspects of this engrossing problem. The Prussians, crushed at Jéna (1806), only required seven years to take their revenge at Leipzig (1813), where the bewildered French saw arrayed against them a formidable army which the Prussians had managed to secretly prepare and efficiently equip under the very eyes of Napoleon's generals! This time the Germans will not need to wait so long to have a tremendous superiority over France in the matter of numbers, financial and industrial resources, and also preparedness for the novel conditions of warfare (aerial and chemical) that so well lend themselves to secrecy.

General Magnin, who has made an extensive tour through Germany, was deeply struck with the industrial prosperity and capabilities of uninvaded and intensely revengeful Bocheland, and, considering all points, especially the fact that next time France must rely on her sole forces, he sees no other

way of avoiding defeat than by bringing to the rescue one million trained African soldiers across the Mediterranean and the Atlantic, which, of course, is only possible with the command of the sea, and calls for an additional French naval effort it would not be safe to delay any longer.

The non-execution of the Versailles Treaty makes of Germany the real victor of the Great War. General Magnin is convinced that the Berlin War-office could very shortly put in the field seven million trained soldiers, equipped with superior post-war armament, and especially with superior Berthas and chemical organization; and, comparing the situation of weakened and devastated France, he thinks the official singing of *Deutschland über alles* by all German sporting and military associations is no mere bravado. France, the only barrier between Deutschthum and European hegemony, is getting too weak for the task her geographical situation imposes upon her. General d'Urbal is of opinion that the only hope of success lies in prompt offensive far into Germany that ought next time to be used as the battlefield.

That the quality of the shell, or of the bomb, is a determining factor at sea has been demonstrated at Jutland and in other encounters. Hence the importance attaching to the series of experiments that, ever since the armistice, have been going on in France, both afloat and ashore, with a view to embodying in naval ammunition both the lessons of the war and the results of scientific progress, especially in the chemical line. It was this French liking for experiments and innovations that brought to life the famed "obus alourdi," the best pre-war projectile. The 1921 tests in the ex-German *Thüringen* off the Brittany coast gave proofs of the excellence of the new 13.4 and 18-inch shells, whilst the aerial bombardments to which the ex-Austrian *Prinz Eugen* was submitted last year opened the eyes of unbelievers to the capabilities of aerial weapons, finally bringing about a reorganization of the Admiralty aeronautical department under Admiral Lanxade, who is a go-ahead, fearless aeronaut and aviator. The *Prinz Eugen*, twice sunk and raised, is being patched up anew preparatory to being towed to sea for the purpose of being used as a target at extreme range by the 12 and 13.4-inch weapons of the Salaun fleet, the *coup-de-grâce* to be given by Latham and Nieuport bombardment seaplanes, and, if need be, by long-range torpedoes. The first part of the firing programme is to take place next month, and, later on, will be continued in the target-ship *Vergniaud*.

The aerial force is all one, being susceptible of being employed either over land or sea, at least for the purposes of European warfare. French public opinion regards air power as being of more moment than sea power, and takes it for granted that France is still supreme in the air. But, if critics are to be trusted, this is far from being the case. Député Boussenot declares that France is defenseless both on sea and in the air. Député de Montgou can hardly master an adequate supply of sarcasms to express his contempt for the confusion and inefficiency prevailing in the army aerial service, as the result of incompetent non-flying senior officers being placed in charge of aerial departments and of aerodromes: plenty of gold stripes and stars, but no notion of aerial requirements, and about the mind of a hen having hatched ducklings! Everywhere grumbling, disgusted aviators, and flying matériel in poor condition: the situation he considers worse than it was on the eve of the war, and he has no doubt as to the virtual superiority of German aviation. Aerial journals are naturally joining in this fine concert of lamentations and taking aerial authorities to task for their grievous mistake in exclusively considering the requirements of military aviation and in ignoring the needs of commercial aviation. A spirit of discontent also prevails in the large aeronautical associations, and the recent Bourget aerial tournament was poorly managed and not the success it had been expected to be.

It is only right to remark that France is "le pays de la libre critique" and that things have a way of never being quite so bad as depicted, and, on the other hand, the present wave of criticism can but spur the authorities to action and make the flying army of France even more efficient than it is now. The number of efficient pilots is steadily increasing in and out of the army.

Recent tests near Paris showed that a Spad or Nieuport "avion de combat," good for a horizontal speed of some 160 miles per hour, can climb to a height of 6,000 yards in 15 minutes, which means a considerable advance on war performances, and is also of vast importance in connection with the defence of cities and ports against bombardment squadrons. France has not forgotten how her finest cities suffered from the superiorly-equipped night bombardment squadrons of Bocheland. In the matter of carrying power, weight and destructiveness of bombs much progress has of late been made.

It is typical of the extent to which the French navy has sacrificed her interests to the Allied cause that she should only be just recovering from the effects of the war and be now completing the destroyer *Gabolde*, of 82.6 métres length 8.2 métres width, and 930 tons displacement, that was commenced so far back as November, 1913, by the Normand chantiers at Havre and is merely preparing for her trials. Modifications have been made in the original designs, and the *Gabolde* will be the most interesting and powerful French-built flotilla unit. Her trials will be awaited with all the more interest as her builders have to maintain a time-honored reputation for speed, having given to the French navy her fastest and most reliable contretorpilleurs from the 31-knot *Forban* (1895) down to the 36-knot *Bouclier* (1909). The new destroyer has four Normand boilers and five Parsons geared turbines, and is expected to develop at least 23,000 h.p., against 18,000 h.p. for her earlier sister ships *Koux* and *Lestin*, which did 31-knots, and against 18,000 h.p. also for the Italian boats of the Medici class (1916-19), some of which reached 34 knots, with a displacement of 830 tons. No wonder she is expected to do 35 knots in a light condition. It will be remembered that the war-built British destroyers of the *S* and *T* series, of about similar displacement, much excelled on this figure in service.

The *Gabolde* is something of an experimental vessel in the shape of her hull and in her armament of three 4-inch guns, two of which are super-imposed to fire right ahead, as in the British Verdun class. She is thus designed for offensive work, which is rather unusual in the Gallic navy, and tactically, apart from her superiority in speed, she surpasses both the German-built *Chastangs* and the French-built *Aventurieurs* (1,000 tons, 29 knots, and four guns of 4-inch on the axial lines). She will reinforce this summer the Channel flotilla under Captain Valdenaire.

Rear-Admiral de Cacqueray (born 1867), who rendered distinguished services as flotilla commander in the Adriatic (being promoted for his dash and ability), is this summer to show the Tricolour in the Pacific with the two 12,600-ton armoured cruisers *Hugo* and *Ferry* (1903), carrying 20 guns of 6.5 and 7.6-inch, of imposing appearance, and very roomy and comfortable, that have just benefited from extensive refit and are good yet for 21 knots. These four-funnelled cruisers are, of course, obsolete in speed but their armament is superior to that of any modern light cruiser.—*The Naval and Military Record*, 14 June, 1922.

NEW ESTIMATES.—The naval programme was passed by the Senate on March 16 by 197 votes to 96. The Minister of Marine is authorized to lay down during 1922 three light cruisers, six destroyers, twelve torpedo boats and twelve submarines. The conversion of the half-built battleship *Bearn* into an aircraft-carrier is also to be started. The gunboats

Moqueuse and *Malicieuse* are to be transferred to Saignon for sea-police and hydrographical duties.—*Journal of the Royal United Service Institution*, May, 1922.

JAPAN

NAVAL SHIPBUILDING IN JAPAN.—According to recent advices from Japan, the conclusion of the Naval Limitation Treaty threatens to cause a serious dislocation of trade and industry in that country. Since the slump in mercantile tonnage set in a great many of the shipbuilding yards which sprang into existence during the war have closed down, while those that remain are finding it more and more difficult to carry on business. When the European War broke out there were only four yards in Japan which could construct ships of more than 1000 tons, but in 1918, when the tonnage boom was at its crest, the number of yards capable of building such vessels had risen to forty-five. To-day only about sixteen survive, and few of them are working on a profitable basis. With the steady falling off in the demand for new merchant vessels, the Japanese shipyards have come to rely largely on naval contracts to keep them employed, so much so that by the end of last year these contracts represented nearly 70 per cent. of the total work on which they were engaged. At this juncture was announced the Government's decision, in conformity with the Washington agreement, to stop all further work on capital ships, and the position of the shipbuilding and kindred industries at once became critical. At the same time the labor element began to grow restive at the prospect of widespread unemployment following the contemplated dismissal of so many workmen from the naval arsenals and private yards. It was estimated that the complete suspension of all the naval construction in progress last November would have involved the discharge of at least 100,000 workpeople from the shipbuilding, engineering, and other trades which are interested in the construction and equipment of warships. So large and sudden an accession to the ranks of the unemployed would have been a serious matter at any time, but it threatened to entail particularly grave consequences in view of the general economic depression from which Japan, in common with all other industrial States, has been suffering for the past three years. The authorities realized, therefore, that unless something was done to ameliorate the situation, naval disarmament, so far from proving beneficial, might land the country in serious domestic difficulties. Nevertheless, they lost no time in fulfilling the obligations which they had assumed in signing the Limitation Treaty. In January last, orders were issued from Tokyo to cease all work on the capital ships then under construction. The vessels immediately concerned were six in number, namely, the battleships *Kaga* and *Tosa*, already afloat; the battle-cruisers *Amagi* and *Akagi*, which were getting on towards the launching stage, and two similar ships, the *Atago* and *Takao*, of which the keels had been laid only a month or two beforehand. In round figures the six vessels thus discontinued had an aggregate displacement of 250,000 tons, and at least 25,000 workpeople were employed either in their actual construction or the manufacture of their machinery, armament, and equipment.

Now, although the Limitation Treaty places definite restrictions on the number of new capital ships and aircraft-carriers that may be built by any one of the signatory powers, it imposes no such limit on the building of what are described in the document as "auxiliary combatant craft," which include every type of vessel from and below the light cruiser. In these circumstances the Japanese Government decided that the industrial crisis could best be allayed by substituting as many smaller war vessels as possible for the cancelled capital ships. A large number of light cruisers, destroyers, submarines, and fleet auxiliaries had been authorized under the programme of July, 1920, which was to cover a period of eight years, but

apparently the last of these vessels was not due to be completed before the year 1928. Whether special legislation will be necessary to anticipate the original dates of laying down is uncertain, but in any case it seems that a considerable number of such vessels have been begun since the beginning of the year. With regard to light cruisers, the position is as follows:—Completed during 1921—*Kiso, Ohi, Kitakami, Nagara.* Launched during 1921 and now nearly completed—*Isudzu* and *Natori.* Begun during 1921—*Yura, Kinu, Abukuma, Kaku.* Laid down or authorized to be laid down in 1922—*Naka, Sendai, Jintsu, Ayase, Otonase, Minase, Yubari.* Of the above ships, the *Yura* was launched on February 15th, and the *Kinu* is said to be afloat, though her launch has not been officially notified. It is reported on good authority that, with the possible exception of the seven ships commenced or due to be commenced this year, all the light cruisers enumerated are of practically uniform design. The leading particulars of them are as follows:—Length overall, 535 ft.; breadth, 47 ft.; draught, 16 ft.; normal displacement, 5,600 to 5,900 tons. The machinery consists of geared turbines—Parsons in some ships, Curtis in others—taking steam from twelve boilers of a special Japanese design, resembling the Yarrow type. In the course of her trials the *Nagara* developed 65,000 shaft horse-power, equivalent to a speed of 33.4 knots, which is a higher speed than has yet been recorded of any other cruising ship in the world. It is possible, however, that the run in question was made when the vessel was in a very light condition, as is customary in Japan when the preliminary trials of a warship are being held. Eight of the twelve boilers in each ship burn oil only, the remaining four being fitted for coal and oil. So far as is known, the only Japanese cruisers with a complete set of oil-burning boilers are the *Tatsuta* and *Tenryu,* completed in 1919, which are very likely enlarged destroyers, and made 33 knots on trial with 51,000 shaft horse-power. The later ships have side armor of about 2 inch thickness amidships, and are well subdivided—a form of protection which has been very skilfully developed by Japanese designers since the war. As main armament seven 5.5 inch 50-calibre quick-firing guns are carried, all disposed on the centre line and at the same level. In addition, there are two 3 inch anti-aircraft guns and eight above-water torpedo tubes, twin mounted. The fuel supply is said to be larger than is usual in vessels of this type, and with maximum storage the cruising endurance at economical speed is 6,000 nautical miles. It is known that a much improved design, with considerably larger displacement and heavier armament, has been prepared by the Director of Naval Construction, Vice-Admiral Okada, and in all probability several of the ships laid down in the current year will be of this improved type. In numerical strength the Japanese cruiser fleet is second only to the British, and far surpasses the American. For light cruisers built, building, or authorized, less than ten years old from date of completion and with speeds above 25 knots, the present figures for the three navies are as follows:—British Empire, 54; Japan, 26; United States, 10.

The Japanese destroyers under construction early this year numbered at least twenty, of which more than half are large and powerful boats, resembling in dimensions and armament the British destroyers of the "Admiralty W" class. Orders for a further twelve destroyers are reported to have been placed, but in the case of these later boats the building period will be intentionally prolonged. No dependable information is available respecting the submarine programme, but at least six yards, including the State arsenals at Yokosuka, Kure, and Sasebo, have submarines on the stocks. In February last the Kawasaki yard at Kobe announced that it had on its books the contracts for twelve submarines, of which, presumably, some had still to be laid down.

While it is clear from the foregoing brief survey that a considerable amount of new naval construction is still proceeding in Japan, the work in

hand does not in any way infringe the provisions of the Washington Treaty. The Japanese Government is no doubt as sincerely desirous as any other of avoiding a repetition of the building-ship rivalry which has always been a fruitful cause of international conflict. At the same time it has not seen its way to adopt that policy of complete naval disarmament which would have brought ruin upon an important branch of domestic industry.—*The Engineer*, 26 May, 1922.

JAPANESE NATIONAL DEFENCE.—The Tokio paper *Yomiuri* gives the following version of the "new national defence scheme" which is said to have been approved by the highest military and naval authorities: "Owing to the changes in international relations, Japan can no longer rely on the assistance of Britain and America, as she could at the time of the war with Russia. In the event of war, therefore, there is no alternative for her but to continue it by the single-handed efforts of the Empire and try and win a final victory, keeping up, if necessary, a war of four or five year's duration. So the Imperial Army and Navy must devote their whole energies in concert to maintaining sure connection with the Asiatic continent to the last. With the object of accomplishing the above mentioned fundamental object, the national defence lines of the Empire are fixed as follows:—At sea, the line connecting Shumushu Island in the Kuriles, the Bonins, Amami Oshima, and Formosa shall be the first line of national defence, and the command of the neighboring waters of the Pacific, the East China Sea, the Yellow Sea, and the Sea of Japan is to be absolutely maintained. On land, the line connecting Hankow, Shantung, Harbin, and the frontier of Saghalien shall be the first line of national defence, and the area within the line shall be the district for operations in order to ensure communication and connection with the mainland. The Strait of Tsushima shall be the second line of national defence with a view to making a prolonged war practicable.

"The Army.—In order to strengthen the military defences, the garrisons in Formosa, Saghalien, and Korea are to be reinforced first of all. Communication is to be ensured with . . . in order to get coal on the Continent and with . . . in order to get iron, while with a view to obviating any possible sudden change in international relations . . . is to be seized, and in order to secure food supplies from Manchuria, the two points . . . and . . . are to be seized. The remaining troops are to be formed into a force for the line of battle in order that the connection through the Strait of Tsushima may be ensured by means of subsidiary vessels and the army, in the unfortunate event of it becoming impossible to rely on the strength of the main fleet.

"The Navy.—Conditions having become unfavorable to aggressive operations on the high seas as a result of the limitation on capital ships, the first line of national defence shall be desperately defended. Surprises at night are to be resorted to as a rule. But in the event of a balance of strength being secured, aggressive defence is to be ventured upon in the near seas. Throughout the war every effort is to be made to ensure the connection between the Continent and the main land (of Japan)."

Commenting on the above plan, the *Yomiuri* says: "Should such a plan be adopted and carried out, the resolution for a limitation of naval armaments reached at the Washington Conference, the spirit of international co-operation, the resumption of amicable relations with Siberia and China, will all be trampled underfoot, and Japan will be reduced to a position of entire diplomatic isolation. Even though the authorities concerned may not immediately demand a substantial increase in armaments, it will be ultimately necessary to convert the country into an entirely militarist State in order to carry the scheme into execution. Neighboring countries will have to be seized upon and placed under military occupation. Social

and economic interests at home, as well as diplomatic and trade relations abroad, will all have to be sacrificed thereto, with the result that the country will be regarded as a second Germany. This policy of self-sufficiency and self-supply will thus prove a suicidal and fatal policy for the nation. There will no longer be any question of relieving the burden of taxation, and nothing more will be heard of cultural measures and social problems. How are the Government, the Diet, and the nation going to face the challenge thrown down by the military clique?"

According to other Japanese papers, a revision of naval policy was decided upon at a meeting of admirals and high officials of the Navy Department held at Tokio on April 6, when Admiral Baron Kato, Minister of the Navy, made a detailed report of the naval proceedings which took place at Washington during the late Conference. The *Mainichi* states that many of the flag officers present put forward the view that the reduction of the Japanese Navy from an "eight-eight" basis to that of a "six-four" squadron should be compensated for by paying greater attention to the training of officers and men, and to the achievement of a higher degree of efficiency in the various weapons used by the fleet. Amongst the decisions approved at this meeting was one in favor of spending more money on battle practice, torpedo running, and experiments with explosives. A further proposal was that a number of superfluous admirals should be retired forthwith to accelerate promotion, thus giving better opportunities for advancement to young and talented officers. Each admiral compulsorily retired is to receive a solatium equivalent to two years' full pay. The vote for naval educational purposes is to be doubled and an extensive programme of gunnery, torpedo, and other experiments against ships on the disposal list is to be mapped out. It is announced also that in order to restrict unemployment in the dockyards five special service ships are to be laid down at an early date, work on subsidiary craft (presumably cruisers, destroyers, and submarines) is to be accelerated, and every effort made to give the dockyards a large share of the work in connection with breaking-up condemned warships. On the other hand, the extension works at Kure and other naval ports, including the construction of large graving docks and basins for capital ships, will not now be proceeded with, as the requirements of the limited post-Conference squadron are adequately met by existing facilities. Contrary to rumor, it is not proposed to close the naval stations at Maidzuru and Port Arthur, but neither port will be further developed.

An interesting ceremony took place at Kure in April, when a number of warships belonging to that station were paid off for disposal. The vessels in question were the battleship *Suwo*, the surveying ship *Yamato*, the old cruiser *Chiyoda*, the destroyers *Murasame*, *Asagiri*, *Asashio*, *Shirakumo*, and *Kagero*, and four torpedo boats. Before each ship was paid off the crew mustered on the quarter-deck, facing the ensign, and were addressed by the commanding officer, after which all present sang the National Anthem, and the ensign was then lowered. A few of the vessels in question are to be kept for subsidiary service, the *Suwo* being earmarked for service as a submarine school and the *Chiyoda* as a depôt ship for submarines, but the remainder will be broken up.—*The Naval and Military Record*, 31 May, 1922.

WATCH JAPAN.—It is doubtless no more than a coincidence that at the moment certain British papers are putting up the headline "Watch Japan" we find in an American Service contemporary an article headed "Is Japan Sincere?" The circumstance which appears to arouse apprehension is not the same in both cases, but behind it is the fact that the Pact of Washington has given to Japan a naval predominance in the Pacific which, if it existed before, had not been so widely realized as it is now. The New York paper says: "We are now impotent against any effort by Japan contrary to

American interests in the Orient." Over here it is reported that in Australia grave uneasiness is caused by the programme of shipbuilding which Japan has in hand. The American writer is not so much concerned about the ships, but protests against the unwisdom of reducing the naval *personnel* when it is not in the bond. Practically the same thought must have its influence in Australia, for when the *Sydney Morning Herald* considers it will now be essential "for the Mother Country and the Dominions, especially Australia, to co-operate in the establishment of an adequate cruiser squadron in the Pacific," the first question to arise concerns the provision of trained officers and men for the crews of such a squadron. Yet the same papers which print the Australian appeal are crying out for a further reduction of our naval strength.—*Army, Navy, and Air Force Gazette*, 17 June, 1922.

JAPANESE DENY EVADING TREATY.—The admiralty today issued a formal statement flatly denying recent reports that Japan was evading the Washington naval treaty by increasing construction of auxiliary vessels.

The statement, which outlined the tentative auxiliary program, also announced that Port Arthur, taken from the Russians in the Russo-Japanese war, would be abandoned as a naval port.

Japan's auxiliary naval program, according to the admiralty, while still uncompleted, probably will consist of four cruisers of 10,000 tons each, and 4 of 7,000 tons each, 24 first-class destroyers with an aggregate tonnage of 33,000, and 24 submarines with an aggregate tonnage of 28,166.

This, says the official statement, represents a reduction of 13,395 gross tonnage, or 1 cruiser, 13 destroyers and 24 submarines less than the original program for ships to be completed in 1927.

Obsolete ships will be scrapped as new ones of the same type are completed. The new plans involve a greater total cost than the old program, owing to increased expenses in material and labor, but saving is to be effected by converting the port of Maidmura from a naval base to a naval port and abolishing the naval port of Port Arthur. This will be accomplished as soon as ratification of the Washington treaties is a fact.

The reduction in tonnage will necessitate dropping 12,000 officers and noncommissioned officers from the naval rolls.—*Baltimore Sun*, 4 July, 1922.

GERMANY

THE SUPER-DESTROYER TYPE: A REJOINDER TO CRITICISM.—Some remarks of mine published in *The Record* of October 12 last under the caption, "A German Shipbuilding Failure," and dealing with the design and seagoing qualities of the big German flotilla leaders *S 113, V116*, etc., have aroused the ire of Herr Ahnhudt, a well-known German naval constructor, who, in the latest number of *Schiffbau* reproduces the offending article in full and endeavors to confute my statements. He declares that the type in question, so far from being a failure, proved completely successful on trial, and suggests that the erratic behavior of the *Amiral Sénès (ex-S 113)* since she has been in the French service was due to French ignorance of her design, which embodies, inter alia, a system of anti-rolling tanks on the Frahm principle. He then affirms that the selection of the *Amiral Sénès* to convey President Millerand on his recent voyage to Africa proves the vessel to be an admirable sea boat, and concludes with a homily on the wickedness of foreign critics who seek to disparage, from base and sordid motives, the faultless products of German science and industry.

Herr Ahnhudt should be more careful of his facts. It was not the *Sénès* but the cruiser *Strasbourg* that conveyed President Millerand to Africa, though the *Sénès* was detailed for escort duty on this occasion, when, according to Press reports, she again distinguished herself by the violence of her rolling. He is mistaken also in assuming that the French, when they took over *S 113*, were ignorant of her anti-rolling device.

This was discovered when Allied officers paid their first visit of inspection to the *S 113* and *V 116*—that is to say, a considerable time before they were handed over to France and Italy respectively. It consists of two wing compartments abreast the two aftermost boiler-rooms, connected by cross-passages under the boilers, and holding about 250 tons of oil. There are other interesting features in this type, which possibly represent the boldest departure from conventional practice that German constructors ventured to make during the war. On paper they were easily the most powerful destroyers ever built, and in particularly favorable conditions of weather and visibility they might have justified their conception of wiping up any hostile torpedo craft that ventured to oppose them.

Infinite pains had been taken to localize damage above and below water, and there is no doubt that the *S 113* and her sister would have been hard to sink by gunfire, ramming, or sub-surface attack. Each of the four oilfired boilers was in its own watertight compartment; each set of machinery—turbine straight drive—with its condensers, was isolated; and the double bottom and wing compartments extended throughout the machinery spaces, oil fuel being stowed in the double bottoms beneath the boilers. Generally speaking, the sub-division was as good as it possibly could be in vessels of the given tonnage and dimensions, though the inevitable result was to make space below deck very cramped, especially in the engine-rooms. The total oil capacity is understood to have been about 640 tons, including oil in the anti-rolling tanks, which was equivalent to a steaming endurance of 3,400 miles at 15 knots. German accounts claim for the type a maximum speed of 36 knots; other authorities consider 32 knots to be the best that the boats could do at full load. The armament comprised four 5.9 inch (40-cal.?) guns on mountings giving very high elevation, and four 23.6 inch torpedo tubes. Herr Ahnhudt denies that any structural changes were made or contemplated in these vessels after completion, and I accept his assurance, though it was reported, on apparently reliable authority, that at the date of the armistice the bow section of one or two of the class was being rebuilt. The account of the *Amiral Sénès'* alarming behavior under helm—as given in the *Record* of October 12—was communicated to me by an officer who was on board the vessel when she circled the Allied fleet at Havre during the Maritime Week last year.

Herr Ahnhudt is altogether wrong in his surmise that a plot exists among foreign critics to throw contempt on German shipbuilding. In England, at any rate, the many excellent features of German naval construction before and during the war have been frankly acknowledged, though there is a natural reluctance to admit that German designs were pre-eminent in all respects. As one who has studied both German and British technical literature for many years past, I have no hesitation in saying that British journals, as a rule, judge every foreign design on its merits and display no national bias in such matters. On the other hand, the German technical Press damns everything foreign on principle, and in particular seems absolutely incapable of printing an objective and detached criticism of any foreign naval design. Before the war a widespread and obviously subsidized propaganda campaign was conducted in Germany for the purpose of disparaging British shipbuilding and naval equipment, and it looks as if this campaign has now been revived. As regards German construction, the most damaging criticism I have ever read was that which the late Admiral von Pohl gave in his diary *Aus Aufzeichnungen und Briefen während der Kriegszeit*. Special attention may be directed to the admiral's letters dated March 16, July 17, July 19, and August 17, 1915, which throw a flood of light on the defective state of the machinery in many of the best ships belonging to the High Sea Fleet, and that a period before the efficiency of the personnel had begun to deteriorate.—*The Naval and Military Record*, 7 June, 1922.

UNITED STATES

SHIPS—BUILDING AND PROJECTED

NOTE: No Restrictions on Any Type Except Capital Ship and Aircraft Carriers.

	Great Britain		United States		Japan		France		Italy	
	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons
Light Cruisers, 1st line	0	0	10	75,000	15	81,900	3	24,000	2	16,000
Destroyer Leaders	1	1,750	0	0	0	0	6	14,400	6	12,270
* Destroyers, 1st line	3	3,725	3	3,645	50	58,500	12	16,800	12	11,680
Submarines, 1st line.	4	5,800	36	31,561	23 52	20,394 Tonnage Unknown	12	13,200	4	2,600
†Fleet submarines	0	0	3	6,375	0	0	0	0	0	0
Aircraft carriers.	Estimated all Powers will Build Aircraft Carriers up to Tonnage Allowance									

* 12 Additional Destroyers authorized but not under contract.
† 6 Additional Fleet Submarines authorized but not under contract.
Note: Aircraft Carrier tonnage allowed by Treaty as follows:

United States —135,000
British Empire—135,000
Japan — 81,000
France — 60,000
Italy — 60,000

No aircraft carrier to exceed 27,000 tons except that each power may build two of 33,000 tons providing tonnage allowance not exceeded thereby.

SHIPS RETAINED JUNE 1, EXCLUDING THOSE TO BE SCRAPPED UNDER TREATY

	Great Britain		United States		Japan		France		Italy	
	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons
Capital Ships	22	*580,450	18	†500,650	10	301,320	10	221,170	10	182,800
Cruisers, 1st line	6	77,200	0	0	0	0	0	0	0	0
Cruisers, 2nd line	4	46,100	11	139,450	6	54,672	10	119,108	5	46,500
Light cruisers, 1st line	45	189,415	0	0	14	71,350	4	19,402	5	21,000
Light cruisers, 2nd line	15	80,345	12	43,175	4	15,830	1	3,444	5	17,300
Destroyer Leaders	20	34,478	0	0	0	0	1	2,485	6	10,300
Destroyers, 1st line	182	206,433	292	346,946	55	57,240	20	19,122	27	21,649
Destroyers, 2nd line	6	4,200	21	15,582	12	7,850	24	16,397	16	11,840
Submarines, 1st line	47	38,333	57	35,134	23	20,374	24	18,403	10	8,040
Submarines, 2nd line	34	14,608	28	10,975	10	3,259	24	9,610	33	9,610
Fleet Submarines, 1st line	6	11,280	3	3,318	0	0	0	0	0	0
Fleet Submarines, 2nd line	6	7,200	0	0	0	0	2	3,094	0	0
Monitor Submarines	3	4,800	0	0	0	0	0	0	0	0
Aircraft Carriers, 1st line	4	62,590	0	0	0	0	1	24,830	0	0
Aircraft Carriers 2nd line	3	25,900	1	12,700	2	15,375	0	0	0	0

* On completion of two new ships to be constructed Great Britain will scrap four capital ships, and total tonnage retained will be 558,950.
† On completion of *West Virginia* and *Colorado*, United States will scrap *North Dakota* and *Delaware*, and total tonnage retained will be 525,850.

SHIPS TO BE SCRAPPED BY TREATY

	Great Britain		United States		Japan		France		Italy	
	No.	Tons	No.	Tons	No.	Tons	No.	Tons	No.	Tons
Old Capital Ships...	20	408,500	15	227,740	10	164,000	0	0	0	0
Capital Ships under Construction..	0	0	13	552,600	6	255,800	0	0	0	0

Note: Any of the powers may retain any two ships, which would otherwise be scrapped, for conversion to aircraft carriers, providing displacement of each does not exceed 33,000 tons.

—*Navy Department Bulletin*, 26 June, 1922.

FEDERAL TAXES COMPARED WITH STATE, COUNTY, AND MUNICIPAL TAXES.—Mr. McLaughlin of Nebraska. Mr. Speaker, under the leave granted to me to extend my remarks I will print the following letter from Captain L. M. Overstreet, United States Navy, showing the amount of Federal taxes compared with State, county, and municipal taxes.

The letter is as follows:

WASHINGTON, D. C., *February 11, 1922.*

MY DEAR MR. MCLAUGHLIN: There seems to be a general feeling that a holiday in battleship building will greatly reduce taxes. A little study of budgets and taxes shows the fallacy of this idea. In our county of York, Nebr., the tax is nearly $40 per capita to meet township, county, and state budgets. The per capita tax for the whole United States for building battleships this year is 64 cents, but Nebraskans contribute about half this amount due to their small Federal income tax, as will be shown later.

According to the World Almanac, 1922, the city of New York has a population of 5,620,000 with a city budget of $345,530,000 (including county budgets and $22,041,000 which goes to the state); the state of New York, a population of 10,385,000, with a state budget of $145,798,000; and the United States, a population of 106,000,000, with a national budget of practically $4,000,000,000. Of this national budget of $4,000,000,000, about 10 per cent, or $400,000,000, is allotted to the entire Navy, and but 1.7 per cent of the national budget, or $68,000,000, to continue the construction of battleships and battle cruisers during this present fiscal year.

If we prorate, according to population, the money to be raised in New York City to help support the government of New York State and of the United States, we find that the people of New York City must raise annually $313,460,000 to support their own city, $10,029,000 to support the five counties in New York City, $78,000,000 to help support the State government, and $212,000,000 to help support the United States Government, or a total of $613,489,000. This means that for every dollar the New York City taxpayer contributes to build battleships and battle cruisers (year ending June 30, 1922) he pays $78 to meet city expenses; $3 to meet county expenses; $22 to meet New York State expenses; and $58 to meet the expenses of the United States Government (building battleships omitted). A holiday in building battleships would reduce expenses in New York City from $100 to $99.38, or a reduction of about six-tenths of 1 per cent.

In the following table a comparison is made between the total annual expenses of New York City and the portions spent on the whole Navy and on building battleships:

Total expenses	$613,480,000
Spent on whole Navy	21,200,000
Spent building battleships	3,604,000

In Chicago the annual amounts to be raised are as follows: $132,000,000 for the city (additional funds are raised for parks and for the sanitary district); $10,800,000 for Cook County; $25,300,000 for the State of Illinois; and $100,000,000 for the United States Government, or a total of 268,100,000. Of this amount, about $10,000,000 would go to the whole Navy and $1,700,000 to continue building battleships. The following table illustrates the annual expenses of Chicago graphically:

Total expenses	$268,100,000
On whole Navy	10,000,000
On building battleships	1,700,000

In San Francisco the city must raise annually $24,467,000 to meet city and county expenses: $6,033,000 for the State expenses of California; and $19,170,000 for the United States Government, or a total of $49,670,000. Of this, $1,917,000 would go to the whole Navy and $326,000 to continue construction of battleships. The following table shows these figures:

Total expenses	$49,670,000
On whole Navy	1,917,000
On building battleships	326,000

From these tables it will be seen that the reduction in city expenses, due to a holiday in battleship building, will hardly be noticeable. This is a popular saying: "The taxpayer is groaning under a crushing load of taxes for battleship building." The above figures do not support such a statement.

Many papers have stated that we will save hundreds of millions annually by stopping battleship construction. How can this be when we are only spending $68,000,000 this year to build battleships? Now, when we break our contracts with the shipbuilders and scrap these ships it will take much of this sixty-eight million to settle legitimate damage claims. The remainder will be needed for the five plane carriers which we are to build in accordance with the terms of the treaty.

What About the Farmers?

Some may say, "Why these charts illustrate what the city taxpayers save by the holiday in building battleships, but what about the farmer?" It will be shown later that battleships are built from money obtained from the Federal "ordinary receipts." The farmer contributes to these Federal "ordinary receipts" a slight amount through the customs (duty on imported articles he might purchase), a slight amount through internal revenue, and, thirdly, directly through his personal Federal income tax. It is assumed that the farmer does not pay a corporation income tax. After taking out his exemptions for himself, wife, and children, few farmers pay much Federal income tax.

In fact, the Treasury Department publication, Statistics of Income, 1919, Income Tax Returns, shows that over half (or 56 per cent) of the personal income taxes for the whole United States come from four States—that is, 31 per cent from New York, 10 per cent from Pennsylvania, 8 per cent from Illinois, and 7 per cent from Massachusetts. If we add Ohio, 4.5 per cent; Michigan, 4.4 per cent; New Jersey, 3.7 per cent; California, 3.9 per cent; and Texas, 2.5 per cent, we can show that over 75 per cent of the personal Federal income taxes for the whole United States, including Hawaii, Alaska, and the District of Columbia, come from nine States. Very little personal Federal income tax comes from the agricultural States. The great grain and cattle States of Nebraska, Iowa, Kansas, Minnesota, and the cotton and tobacco States of Virginia, Georgia, Alabama, and Louisiana all together pay but 6.7 per cent of the Federal income taxes, or less than the one State of Massachusetts.

In our agricultural State of Nebraska there were but 87,344 personal Federal income-tax returns from a population of over 1,296,000 in 1919. The taxpayers who make personal Federal income-tax returns in the whole United States pay an average tax on these returns of over $238, while those making returns in Nebraska pay an average of less than $99 per return. While New York State has but nine times the inhabitants of Nebraska, New York State pays over fifty times the amount of personal Federal income tax and nearly sixty times the amount of Federal corporation income tax. Taxes to support the Federal Government come largely from the Eastern States and from large manufacturing districts.

Where Do National Funds Come From?

Where does the money come from which is used to meet the National Budget? The Treasury Department, Division of Bookkeeping, Form 778, shows for the fiscal year ending June 30, 1921, the "ordinary receipts" amounted to nearly $5,573,000,000. This is the money which is used to meet congressional appropriations. Of this amount $308,000,000 came from the customs, $1,500,000 from the sale of public lands, $683,000,000 from miscellaneous items—coinage profits, Pacific railways, tax on national bank circulation, fees, fines, penalties, etc.—$1,352,000,000 from internal revenue, and $3,228,000,000 from income taxes—of which about two-fifths comes from personal income taxes and the other three-fifths from corporation income taxes. The money from these personal Federal income taxes, therefore, meets about one-quarter of the National Budget. As 1.7 per cent of the National Budget goes to build battleships, this means that one-quarter of 1.7 per cent of a taxpayer's personal Federal income tax, or 40 cents out of every $100, will go to build battleships during the year ending June 30, 1922, at a time when we have six battle cruisers and nine battleships under contruction, a number considerably above the average. The cessation of battleship building will, therefore, reduce the taxpayer's personal Federal income taxes from $100 to $99.60, but the taxes on his property to meet city, county, and State budgets will remain the same. From every dollar the taxpayer pays as a personal Federal income tax one-fifth of 1 cent goes to continue the construction of battleships.

Where Do Taxes Go?

Where does the taxpayer's money go? It goes largely to meet city, county, and state budgets, which are constantly increasing at an alarming rate. In New York City the city budget in 1901 was little over $99,000,000; in 1911 it was $174,000,000; while in 1921 it had grown to nearly $346,000,000. The budget of 1910 would not pay the interest on the city debt of 1921, as the debt is over a billion dollars.

In the agricultural States of the West it is surprising to find even higher rates of taxation to meet state and county budgets, with high rates to meet city budgets. The taxpayers of Lincoln, Nebr., a city of only 55,000 people, have to meet a city budget of over $1,000,000; have to meet their quota of a county budget of $534,000; and their quota of a state budget of $30,000,000. Their quota to build battleships (on a population basis), is but $34,000, but on a Federal income tax basis it would be much less.

The agricultural county of York, Nebr.—population 17,146—must raise over $172,000 to meet the state budget, nearly $520,000 to meet township and county budgets. The people of the county seat, York—population 5,388—must raise annually nearly $190,000 to meet city, township, county, and state budgets. The farmer should realize that the tax he pays on his land, buildings, live stock, and crops go to meet the ever-growing expenses of his township, county, and state, and that not one penny of

these taxes goes to build battleships or to the support of the Federal Government.

The following 18 cities have budgets of over $10,000,000 each, given to the nearest million:

		Millions of dollars
1.	New York City	346
2.	Chicago	133
3.	Philadelphia	59
4.	Baltimore	57
5.	Boston	44
6.	Milwaukee	28
7.	San Francisco	24
8.	Buffalo	24
9.	Newark	22
10.	St. Louis	21
11.	Pittsburgh	19
12.	Seattle	19
13.	Jersey City	14
14.	Cleveland	14
15.	Minneapolis	13
16.	Los Angeles	13
17.	Rochester	11
18.	Providence	10

The following 23 states have budgets of over $10,000,000 dollars each, given to the nearest million:

		Millions of dollars
1.	New York	146
2.	Pennsylvania	117
3.	Illinois	60
4.	Washington	59
5.	Ohio	56
6.	California	41
7.	Massachusetts	40
8.	New Jersey	32
9.	Nebraska	30
10.	Connecticut	26
11.	Wisconsin	26
12.	Texas	23
13.	Oregon	23
14.	Michigan	17
15.	Virginia	16
16.	Minnesota	16
17.	Missouri	15
18.	Maryland	14
19.	North Carolina	13
20.	Mississippi	12
21.	Iowa	10
22.	Louisiana	10
23.	Oklahoma	10

No data is available to show how many counties have budgets in excess of $10,000,000, but the five counties of New York City have a combined budget of over this amount, while Cook County, Ill., has a budget of over $12,000,000.

The writer believes that the money appropriated for the Navy is well invested, that the taxpayer contributes but a small part of his taxes to the Navy, and that this amount could not be materially reduced. Further, it seems certain that millions of dollars could easily be saved by cutting city, township, county, and state expenses. This is where the cuts should be made to relieve the taxpayers of this so-called "crushing load of taxation."

Sincerely, yours,

L. M. OVERSTREET,
Captain, United States Navy

HON. MELVIN MCLAUGHLIN, M. C.,
House of Representatives, Washington, D. C.—Congressional Record.

THE MERCHANT MARINE.—The following letter and statement were inserted in the *Congressional Record* at the request of the Hon. Wesley L. Jones of Washington, and are reprinted in part only.

United States Shipping Board,
Washington, June 26, 1922.

Hon. Wesley L. Jones,
United States Senate, Washington, D. C.

My Dear Senator: The President in his message to the Congress has covered the need of a merchant marine as a national necessity for peace and war. He has asked that during the recess of the House Members illumine their constituents on the administration's proposed bill for Government aid to shipping.

* * * * * * * *

In considering the pending legislation it would seem to the writer that final determination need not be dependent on whether one feels that the United States needs a merchant marine, the fact is that the Shipping Board is today in possession of the greatest fleet the world has ever known and which by act of Congress it is mandated to operate on essential trade routes until such time as its vessels can be sold to private owners. That is the situation we are faced with.

The Shipping Board admits that it can not operate its fleet remotely as economically as private owners operate their vessels; the history of the prior boards show that they were unable to put the operation of the Government fleet on a proper business basis. The Shipping Board believes that the fleet under its charge can never be profitably or successfully operated under Government control because of the inherent and insurmountable handicaps incident to the Government ownership of ships. The reasons for these conclusions are elaborately covered in the statement inclosed.

Thus the question to be considered is, What shall we now do with this war inheritance? Shall it be sold to private ownership for operation under the American flag; shall it be sold abroad, possibly some day to rise and plague us; or shall it be junked and charged off to war cost as powder and shell were charged off?

The Shipping Board, approaching the problem as a business problem, believes that few Americans would advocate junking a fleet which cost the Nation vast sums of money. That alternative is dismissed as impracticable and impossible—impossible because such a course would admit to the world that the United States, possessed of a great fleet of merchant ships, was forced to concede that it lacked the ingenuity and ability to convert that fleet to a revenue-getting profitable asset comparable to the merchant fleets responsible for the commercial success of other great nations, and that the United States was bankrupt in statesmanship that visualized the need of keeping alive a merchant marine under its flag for peace and war protection.

The Shipping Board does not believe that the desirable units of America's fleet should be sold abroad, not only because such a course would end for decades any hope of establishing the American flag on the seas, but because it would place in the hands of our commercial rivals added tools to control world trade, would strengthen in certain ways the naval powers of other countries and weaken our own, and would allow citizens of other nations to select the cream of our tonnage at their own prices while the United States paid the great cost of upkeep of the inferior ships left on our hands.

The Shipping Board composed of four Republicans and three Democrats, advised to-day by as competent a staff of experts as possibly any Government organization has ever brought together, averring unanimously that its efforts and the efforts of prior boards have proved that Government operation of ships is an utter impracticability, leaves us as an alternative the attempt to get the Government-owned ships into private hands for operation under private American control.

The administration has a bill now in Congress which the board believes will not only accomplish the establishment of a successfully privately owned American merchant marine but will accomplish it at an actual and substantial saving of money to the taxpayers by substituting profitable private ownership for Government operation that is and has been an unending and almost unmeasured drain on the overburdened taxpayer.

* * * * * * * *

The Government came into possession of this vast fleet through war necessity. The fleet was built hurriedly, without regard to the costs of peace-time operation and without regard to the peculiar necessities of peace-time trade. The result is that we have many ships whose design and machinery will never permit of profitable commercial operation; we have far too many ships of some types, in some cases too many even of the right type; we have not nearly enough passenger ships, passenger-and-cargo ships, and refrigerator ships to constitute a balanced merchant marine for peace purposes or for naval uses in time of war.

There can be no thought of naval equality with Great Britain unless we have as many merchant ships of the proper types suitable for naval auxiliary use as has Great Britain. Fast passenger ships for raider and communication purposes, refrigerator ships to supply the combatant fleet, and airplane-carrying ships to scout for the fleet are almost as necessary to the operations of the Navy in time of war as are naval vessels themselves. In the most valuable types of ships for naval operations Great Britain already has approximately 250 to this country's 50, and when type and speed are considered Great Britain's advantage is even more overwhelming.

The war has changed the United States from a debtor to a creditor Nation. Our sea carrying before the war was almost entirely performed by the nations to whom we owed money. Those nations now owe us. They must try to utilize every advantage in the markets of the world in order to increase their prosperity, and we, with greatly increased productive capacity because of the war, and facing overproduction in the future, must expand our foreign trade, if we are to market our surpluses. Ships are as essential to foreign trade as are goods.

It is not to be supposed that those nations who will be our competitors for the trade of the world will always give us the ships we need when and as we need them. Regularity of sailing and promptness of service is the very life of foreign trade. Inability to market our surplus because of lack of ocean-carrying capacity will inevitably mean depression at home.

The farmer is vitally interested in the merchant marine in many ways. It is probable that the great carrying nations of the world, owing us large sums of money, may attempt, so far as they can, to buy their agricultural needs elsewhere. We must insure under our own flag such speed and prompt delivery to their shores of our agricultural products as will force them to buy from us.

While ocean freight rates were high immediately after the war they would have been higher but for the existence of the American merchant marine. If that merchant marine is permitted to die, a great toll in excessive ocean freight rates may be collected from us by the foreigner.

Unless we have ships of our own to insure our export trade the excess production of farm and mine and factory will constitute a surplus result-

ing in nonemployment in this country that can not but seriously affect the farmer's ability to market his product at profitable prices in the United States. Furthermore, the farmer's demand for adequate inland waterways, as evidenced in the Great Lakes-St. Lawrence Canal and Mississippi River deep-waterway projects, demonstrates the farmer's recognition of the importance of adequate water-carriage facilities to his needs. If and when these waterways are perfected the best insurance of their continued use would be a merchant marine under the American flag.

The United States, once one of the proudest Nations on the sea, has had no merchant marine worthy of the name since the Civil War. The present Government-owned fleet offers the nucleus of a merchant marine commensurate with the position of the United States in the firmament of nations. Realizing the inefficiencies and great cost of Government operation; having demonstrated the impossibility of selling the ships to private American owners under existing conditions, and being well aware of the great differentials faced by American steamship operators as against the shipping men of other nations, the Shipping Board, a bipartisan organization, has unanimously and without political difference among its members recommended a policy of aids to shipping that has become the basis of the administration's proposal to Congress.

That proposal contemplates that should America ultimately get the 7,500,000 gross tons necessary to carry half of our overseas commerce the cost to the Treasury, directly and indirectly, would be something like $40,000,000 per annum. The 400 ships the Government is now operating at a cost of $50,000,000 a year would, under the proposed measure, draw but slightly more than $8,000,000 Government aid.

The administration's proposal limits the profits of any fleet receiving the benefits of Government aid to 10 per cent in any one year, each year standing by itself. There is no guaranty of profit. If a ship after receiving aid loses money that loss is the owner's. If it makes money all over 10 per cent is divided; half going to the Government until all aid advanced to the vessel has been repaid. There can be no possibility of profiteering.

It is believed that the administration's measure will be a money-making proposition for the Treasury. If the bill is adopted and becomes law there will be more money in the Treasury at the end of a few years than would be in the Treasury if the bill is not adopted.

With sufficient Government aid, direct and indirect, to overcome the advantages which other nations have long enjoyed on the seas, private capital will it is confidently felt be attracted into shipping. The Treasury cost, in direct and indirect aids, the first year, if the bill passes, can not possibly be more than $15,000,000.

If at all successful, gradually (and it is hoped by the end of two and one-half years from the passage of the bill) the Government's $50,000,000 annual loss in operation through the Shipping Board will be wiped out. Under any conditions there would always be a substantial difference in favor of the Treasury between the maximum subsidy cost and the cost under Government operation.

The ships are wearing out and still America is impotent on the seas from a merchant marine point of view as compared with other nations. The fleet is bringing nothing into the Treasury and is costing large sums annually. If the ships are sold the proceeds will go into the Treasury to liquidate in some part of their war-time cost. Thus the measure proposed by the administration should accomplish the liquidation of that part of the fleet serviceable under the American flag; it will end the drain on the Treasury resulting from Government operation; it will end the discouragement to private initiative resulting from that operation, and will stimulate Americans to take their proper places in the

ocean-carrying competition of the world; it will insure the building of types of ships necessary not only to America's prosperity but to her preservation in time of need, and it will keep alive the art of shipbuilding in America, now threatened with extinction.

Respectfully,
A. D. LASKER.

What Are We to do with Our Government-Owned Ships?—Do We Need a Merchant Marine for Peace and War?

[Statement by Albert D. Lasker, chairman United States Shipping Board, at the joint hearing before the Senate Committee on Commerce and the House Committee on Merchant Marine and Fisheries on the proposed bill providing aids for American shipping.]

Whether or no America is to be potent on the seas for the next several generations will be decided in the disposition by Congress of the legislation now proposed by the President for the aid and upbuilding of our merchant marine.

The Question at Issue

The matter under consideration is not merely one of subsidy or no subsidy; it involves what shall become of the Government's vast war-built merchant fleet; what shall be done to end the large losses of governmental operation of ships through the Emergency Fleet Corporation; what shall be done to insure the overseas carriage of America's surplus products in times of peace; and it involves, in importance possibly beyond all these questions, whether America, through the possession of an adequate merchant marine, shall be self-sustaining and self-sufficient on the seas in times of war.

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Changes Wrought by the World War

The World War has changed practically every phase of human life. America emerges from that war holding first economic place in the world. She finds herself a creditor nation instead of a debtor nation; and whether we will it or no, we are now cast for continuing first place on the stage of world commerce. No nation ever held that proud position unless she was strong in her own rights on the seas. It is for us here and now to determine whether America shall attempt to refuse the place which destiny has carved out for her.

When Europe awoke that summer morning in 1914 to find herself enmeshed in a World War it was the beginning of a demand for American exports such as the wildest dreams of our greatest empire builders never visioned. That part of the world to whom the seas were still free centered its efforts to send its ships to our shores that they might be laden with the products of our factories, farms, and mines. We ourselves could make but a pitiful showing in the exportation of our own goods under our own flag. And were it not that the maximum production we could give did not even approximate the minimum of Europe's needs we should have been in a sorry plight; for had the war been lesser in area, and therefore the demands of combatants not required all the output we could supply, our great production would not have been used. We could not have had the ships to send our surplus wares to neutrals; and if one of the great maritime nations, say Britain, had solely engaged in a smaller war confined to a narrower but distant area, her ships would have been diverted to her own uses.

Costly Lesson of Boer War

This is exemplified through the Boer War, where the conduct of operations was at a great distance from their base. Britain's ships were needed for long carriage of men and supplies, though not in quantities remotely comparable to the World War. Thus, while Britain did not have pressing need for our production, she had such need of her own ships for the long haul that we were sorely pressed for carriage in our trade with her and other nations, as was evidenced by depression in many of our important commodities. Had we at that time had the expanded factory capacity we now have, the diversion of England's tonnage from our peace needs to her war needs would have been a calamity indeed. As it was, we all remember the serious effect this diversion of British tonnage had on the marketing of our farm products; it demonstrated that the farmer, even more than the manufacturer, was interested in America's controlling her own tonnage. Unfortunately, these lessons, because only transient, are soon forgotten.

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Government Operations Fatal to Private Initiative

Thus we find ourselves to-day with the Government owning 1,442 steel ships aggregating 7,000,000 gross tons, operating 421 of these ships at an estimated cost to the Treasury the coming year of $50,000,000, with 1,021 ships tied up; we find private operations as well being conducted at startling losses, due not only to depressed world conditions but to the impossibility of the private owner maintaining himself in the face of continued Government competition.

The purpose of Government operation as defined by law, was to build up trade routes in order that the Government ships might thus be sold with established good will to private owners. The very method chosen has worked to defeat its own purpose, for in the upbuilding of those routes the Government has operated ships, and in the operation of ships has driven its potential customers largely off the seas. Thus we come to conclusions from which there can be no escape—that since continued Government operations means finally the possible and likely elimination of private operation of American ships a method must be devised whereby the Government shall end its operation and at the same time insure carriage of American goods under the American flag through private ownership as contemplated by the Jones Act.

Must Be Independent on the Seas

We no longer can be disinterested in whether or no we shall have an established American merchant marine. The transition from debtor nation to creditor nation has settled that; the changing needs of our people in imports and changing demands of others in exports all emphasize that we have no assured future of prosperity if we rely on other than ourselves to carry our overseas trade.

Europe owes us, governmentally and privately, some $15,000,000,000. To pay in gold is impossible; there is not that much gold in the world. The only way Europe can pay (to such extent as she may pay) will be in goods, either raw materials or manufactured or partly manufactured wares. In turn, we must find new markets, not only to absorb the surplus products which Europe formerly took from us, but to provide for the sale of many of the products which Europe shall send to us in settlement of her debt. These products, if in raw or partly manufactured state, will be brought to completed processes by American labor; but if we do not find a foreign sale for them, will so depress the price of wares at home as to threaten the prosperity of all of our workers.

These newer markets lie across the ocean—to the south in the Western Hemisphere, to the east in China and Siberia. It is the very need of trade in these markets that is the inspiration of the policy of the open door in the Far East, which means nothing more or less than free opportunity, based on merit, for exchange of wares.

Ships Essential to Foreign Trade Expansion

It is for these very markets that the nations of Europe which owe us vast sums of money will contend with us. And who can be so blind as not to see that Europe will very properly in her own interest find the way and means to refuse us ships when we need them most if that refusal spells her control of markets in which we would compete with her for mastery. It is well enough to say that she will not refuse us the ships if we can pay higher freights, but who supposes that foreign governments will not be sufficiently ingenious to work out plans to control their own ships to benefit their national trade and to our disadvantages even by so doing they bring into their national treasuries possibly lesser freights than we would pay? If a ship in freight receipts could get only $25,000 in Europe and $35,000 here to carry a cargo to the same trade worth $1,000,000, the wise governments of Europe will find ways to equalize the loss in freight receipts to their own carriers; that their national treasuries may be enriched by the sale of the million-dollar cargoes rather than permit us to get those benefits, even though we would pay $10,000 more for the carriage.

America Once Supreme on Seas

In our early days we were a seafaring nation. Our clipper ships excelled the world. With an undeveloped empire to exploit, the spirit of our youth, both from the standpoint of adventure and profit, responded to the inland call. Self-sufficient, self-contained, with abundant natural wealth to the point of waste, we became indifferent to the sea until shortly after the Civil War those nations who had the greatest need of the sea had so manipulated it that America became, other than coastwise, practically a nonmaritime nation. The great World War brought about an increase in our production capacity that defied all preconceived ideas of expansion.

There can be no return to a pre-war basis. Increased overheads through increased capacities demand increased consumption in many lines beyond that which can be found in our home country. The debts Europe owes us, their enforced economy for decades to come, and consequently finally diminishing purchases from us, all combine to require our search for new markets. These markets will inure to us only when sureness of delivery, regularity of sailing, and promptness of service from our ports to theirs is guaranteed. Promptness and regularity are the very essence of foreign commerce. The greatest agents of our foreign commerce are ships of our own flag that must fight for cargoes from and to our shores to insure their profitable operation. The semideveloped countries of Europe, the newer countries which are not self-sufficient in their own rights, will be a fighting ground for trade. And here, too, only through control of our own ships can we be insured of steady markets.

Foreign Trade Now Essential to Entire Country

Aside from all this is our own change in domestic needs. Through our great prosperity we have become, compared to the other nations of the world, a luxury-loving nation. Coffee, almost unknown as a regular beverage in most other countries, is a several times a day necessity at our national table. Three-quarters or more of all the automobiles in the

world are run in America. Their tires alone require untold quantities of rubber. All these luxuries which we import must be paid by exports, and we must insure that these exports shall reach their destination when and as needed.

The freights alone involved in our expanding commerce mount into the hundreds of millions, and it means much to our national wealth whether we retain those freights collectively to ourselves or whether we pay them abroad. If John Smith, the individual, spends $50 abroad and receives therefor wares, he is none the poorer; but if the national John Smith spends $50,000,000 abroad that he could retain at home, the Nation is a great portion of that $50,000,000 poorer.

Farmer Vitally Interested in Export Trade

The farmer has but recently seen what it means to him, in depression in price of his entire production, when exports fail and the surplus of his production backs up at home. We have but lately seen how our Government's expenditure of $20,000,000 plus twelve millions from the Soviet government, for grains to starving Russia marked the beginning of an uprise in price of all our cereal products. From the very time that these purchases began the price of wheat and corn and oats rose. It is not contended that these purchases alone were responsible for the uprise, but they were one of the several factors that resulted in the farmers' depression being alleviated.

Had it not been for the Government's possession of its present steel fleet these export foods could not have been promptly transported, for there was not immediately available in commission adequate private tonnage. No one has a greater interest in an established American merchant marine than the farmer of our country, because it is in the sale of his surpluses abroad that his entire prosperity is involved. Europe, owing us vast sums, will undertake to make its purchases of surplus grains, when it can, in countries other than our own; and it is only through the control of our own deliveries, insuring that they be expeditious and constant, that we can hope to maintain prosperity for our agriculture.

Great Lakes–St. Lawrence Project

The farmers of our 18 chief agricultural states, with a total population of 40,000,000, are making a demand to which an affirmative response seems certain—that the ocean be brought nearer to them by the building of the St. Lawrence waterway, a conception that our Middle States will refuse to surrender until it becomes a reality. There can be no certainty of even a fair trial of that project after it is built unless we can have profitable operation of American ships, because the carriage in that waterway, which it is my ardent hope will soon be constructed, is but seasonable, and other nations might not afford to work out a system of flexibility of tonnage for use in that waterway to our advantage. Assured flexibility for use of that project must come from us and us alone. Therefore, when the farmers' dream of the St. Lawrence waterway comes true, as come true it will, it can have no assured life without an American merchant marine, and that merchant marine should be well established before the canal becomes a reality, that companies of sufficient strength may be alive to take advantage of its opening.

For all these reasons, therefore, in the changed condition of man and time, the economic need of our country demands an American merchant marine if we are to insure the prosperity of future generations on the farm, in the mine, and in the factory, which prosperity can only be insured through world markets for our surpluses—markets protected by American ships carrying American wares.

Merchant Ships Essential as Naval Auxiliary

We have lately seen the close of a great conference here in Washington whereby it is proposed to limit the burden of expenditure for naval armament on the sorely taxed peoples of the world. Our own America, the most prosperous of all the nations, is herself groaning under naval expense. It is because of a revulsion from increased naval armaments, as well as a cry for release from taxation, that the nations of the world agreed on a basis of limitation. Coupled with that are the treaties of the Far East involving the open door in China, which means free opportunity for trade in China. Nations build navies to insure that their merchant ships may carry their wares to all portions of the world unmolested. And so the limitations on our navy and the open door in China, both integrally, are part of our national economic policies. Trade and trade alone are the factors that center world interest in the Far East. The naval needs are to protect that trade.

United States Navy Once Impotent Without Foreign Ship Aid

Having agreed to a naval program of 5-5-3, we can have no thought or hope of actual naval equality unless we can supply and bunker our navy through our own merchant ships in time of war, should that unhappily come again. When President Roosevelt sent our navy around the world, it had to be supplied and bunkered by foreign-flag ships. Our naval giant showed the nations of the world its feet of clay. In 1914, when the World War began, be it said to the shame of America, she possessed but 15 passenger ships of such type as to be of use for naval auxiliary, while Great Britain possessed over 200 such ships. Today we possess 50 to Great Britain's 250. But when age and speed, which are the determining forces in the use of such ships for naval purposes, are considered, Great Britain's margin over us is further increased.

Our Deficiency in Case of War

Should we unhappily go to war with another country, Great Britain not being a party to the controversy because strict neutrality would be to her interest, we would find it difficult indeed to furnish our Navy with the supply and the fuel ships that it needs, in addition to the convertible type of merchant ship recognized as necessary for the second line of defense. For, while we possess a vast tonnage, that tonnage was built during the war in the best ways immediately possible, in order to get maximum production, but without regard to type or balance; so that while in millions of tons we have a formidable array, in the balancing of our tonnage for either war or peace-time purposes we are sorely deficient. There can be no thought of naval equality with Great Britain until we possess a merchant marine in balance and tonnage equal to hers as a second line of defense to our navy and as a source of supply and fuel. It is idle to say that the 5-5-3 agreement brings us in proportionate naval equality with the other two nations involved, unless we do that which is necessary to build up a merchant marine of proportionate size and balance to theirs; for all naval authority in the world affirms that the supplemental merchant marine required by a navy is as essential to its operation as capital ships themselves.

Falling Short of Allotted Naval Ratio

There can be no thought of our maintaining even the naval tonnage allotted to us by the limitations agreement if we are to have no great auxiliary merchant marine. Great Britain has to-day that adequate merchant marine necessary for any operation of the naval tonnage that accrues to her in the Washington agreement. To the extent that we fail to supply ourselves with an adequate merchant marine of the type and

number to balance the naval strength allotted to us in the Washington conference we should do away with the maintenance of capital naval ships. We can not fool ourselves; we only are on a 5-5-3 naval basis with Great Britain and Japan to the extent that we possess on a 5-5-3 basis merchant marine of the type and kind necessary for naval aid.

As it stands today Great Britain will immediately take her place both with naval and auxiliary merchant ships in the 5-5-3 program. We can not take ours to-day, nor for years to come. We still must create many essential types of merchant ships.

When we use Great Britain as an example we do so in the spirit of the greatest friendship, for, happily, no one can ever have a thought of war between the two greatest English-speaking nations; but rather we use her as an example, because Britain, in her attitude in the late conference, showed that she was as desirous as we that America should have naval equality with her, and she knows, better than we, that there can be no naval equality without the proper merchant marine.

Present Fleet Costly War Inheritance

We came into the possession of the vast fleet we own, built under the hysteria of war, for the carriage of supplies of our army and the navy stores. For the carriage of our men we had to rely chiefly on our allies and on seized enemy tonnage. We all realize now that this war-built tonnage, inadequate for peace or war, could have been built to serve a wider and surer purpose at infinitely less expense if created during times of peace. Shall we again be involved in such haste and loss by failing to learn the lesson which has just been taught us? Wherefore, whether we view it from the standpoint of peace or the needs of war, America must develop its merchant marine.

The Jones Act wisely provides, in its preamble, that its purpose is to develop a merchant marine as an aid to the army and navy in war and for the development of American trade in times of peace. We are not able to accomplish these purposes at the present time. Startling as it may seem, in spite of the vast tonnage we possess, we are not now positioned to protect our peace-time trade or to properly care for our army and navy in times of war.

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Government Operation Expensive and Unsuccessful

The Shipping Board, under mandate of the Jones Act to maintain necessary trade routes, is operating 421 ships at an annual loss of approximately $50,000,000. This includes the cost of lay-up, but not the cost of all necessary repairs, though the board is doing such repairs as it can within the figure named. There should be no quarrel at this expenditure of $50,000,000, because thereby we are keeping the American flag flying into all ports of the world, and the American manufacturer and producer is assured of carriage for his wares to his markets when his needs demand. For the year 1921, America carried under her own flag 51 per cent of her total foreign trade. This figure seems to indicate a result much more favorable than the real facts warrant.

If we deduct from our foreign water-borne trade that which is carried on the Great Lakes, in vessels which for the present are immured there, and if we subtract the cargoes carried between this country and the countries bordering on the Caribbean which have no merchant marines of their own and whose trade, therefore, is not competitive, there will remain the traffic in general cargo to overseas continents and nations having merchant fleets and competing with us for these particular cargoes.

Our Standing in Competitive Sea Carriage

In this figure, which represents our real competitive trade, the American ship makes a poor showing. Our exports in this trade are now three and one-half times our imports. Of these exports, foreign ships carried over the entire year an average of 71 per cent, while the American ship carried but 29 per cent, and only reached this figure by virtue of the large amount of coal exported in American ships during the British coal strike.

For December, which represents a recent normal month, foreign ships carried 76 per cent of our overseas general cargoes and 24 per cent was left to be carried in American ships. This 24 per cent measured our success in competing against foreign nations for the carriage of our products to the markets of the world. Of the 24 per cent 19 per cent was carried in Shipping Board vessels and 5 per cent by private American owners.

Must Carry Half Our Own Ocean Trade

It must be the purpose and the aim of America—and the Shipping Board emphasizes its belief that this aim can be accomplished—to carry at least 50 per cent of our foreign trade, other than with contiguous and nearby countries, under the American flag privately operated. The suggestions made to the Congress by the President contemplate within a decade, at the cost estimated by him, that 50 per cent of such trade will be carried under the American flag privately operated. We are to-day carrying 87 per cent of our oil trade with Mexico and 57 per cent of the Caribbean trade in our own ships. But neither the needs of trade with Mexico nor the Caribbean calls for that type of ship which is the very backbone of the second line of defense of our navy; nor does the trade with Mexico or the Caribbean call for that type of ship which is the forerunner of world trade and world intercourse—the fast passenger and combination passenger and cargo ships.

Of the 24 per cent of world carriage in American bottoms here referred to, it is appalling to think that 19 per cent is carried in Government-owned ships and only 5 per cent in privately owned ships, when it is considered that the Government through the Shipping Board, admits its inability to operate on an equally efficient basis in competition with the private ships of the world. Fifty million dollars annually it is costing to keep the Shipping Board boats going—$50,000,000, not including, however, interest, full insurance, or depreciation on invested capital. For any private business to say that it was losing $50,000,000, without considering interest on capital investment, full insurance, or depreciation, would mean that the managers of that private business were attempting to deceive their stockholders by understatement. In the same way it is a deception to the American people to represent that the Shipping Board is losing but $50,000,000 per annum, when that $50,000,000 is lost in operations only and does not consider capital invested.

Where Emergency Fleet Has Already Paid for Itself

There was, however, good reason why the Government at the end of the war should through the Shipping Board have established governmental operation. Not only should there be no apology for this, the facts warranted it, and the time will come when it will prove to have been an act of courage and vision on the part of our people. But the continuance of this Government operation is now as unforgivable as its establishment was sound.

What do we mean by this seeming contradiction? When the World War was over there was a great scramble on the part of all the maritime nations to use their own tonnage for their own peace-time needs

Had America not possessed the tonnage she built during the war, in the two years of prosperity that followed the war we would have lost largely of markets that were ours, much as their need would have been for our wares, because there would not have been tonnage available to carry our goods. Those who needed them would have sent us their ships to the extent that they needed goods, but even then many would not have had enough ships to carry that which they alone needed, and others would not have furnished us their surplus ships for our trade aggrandizement at their own expense.

Government Postwar Operation Necessary

The vast sums we saved to ourselves in freights alone, which through faulty governmental bookkeeping, was converted to construction charges, would have shown during that period that handsome freight returns inured to the Public Treasury. Private operation at that time would have been impossible; there had been but little overseas carriage under the American flag by private owners before the war, and private capital therefore would not have been available at the war's conclusion quickly enough to operate successfully the Government-owned ships, even had the Government sold those ships at fair prices to private owners. So that, in order that the war-built fleet might immediately come into America's peace-time needs, the Government was forced into operation—an operation that from that time to this, through the lack of private facilities, has been the greatest insurance we have to our future overseas prosperity, which involves our entire national prosperity.

Government Operation Inherently Vicious

We believe that the present operation by the Shipping Board is fast approaching as efficient an operation as government can give. But any free competition with the privately owned shipping of the world, through successful Government operation, the Shipping Board avers is an impossibility. The restrictions of congressional legislation, the demands of varying sections of the country, the limitations on free play, from which private business does not suffer, make it impossible for government-owned shipping to compete with the private ships of the world.

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Government Operation Means Eventual Disappearance of Fleet

One of the most formidable objections to continued Government operation to-day—an objection that is insurmountable—is that the ships owned by the Government would in due course wear out, even with proper repairs. No one in Congress suggests, nor have I ever heard it suggested from any source, that the Government should build ships to replace those that are worn out, or that the Government should build new type ships. If there is one unanimous opinion in the country regarding our mechant marine it is that Government construction of merchant ships should cease. Thus the continued operation by the Government of its present fleet would be making no progress toward a permanent policy on the seas or a renewed and enduring merchant marine. This one phase alone calls for legislation along the lines proposed to insure the Government's retirement from ownership and operation.

Permit me to stress that unless the Government rebuilds, even if the Government could stay in operation and give a good operation, which I deny, within less than 20 years the fleet would be worn out and gone. We would be building up no American merchant marine, for, with the Government continuing to operate, private operators would be driven out of business under the American flag. They could not stand the competition. The Government would not be building

new ships, and all that would have been accomplished would be declining Governmental operations under the American flag, with the assurance that the ultimate would be America driven from the seas. Thus the Americans who took to the sea as a profession would ultimately find America without ships of its own flag, and would be driven to ship on foreign ships at foreign wages; whereas by insuring private operations, which will be continuing, we insure American seamen on the sea at American wages. Further, if the Government continues in operation without the legislation asked for, and drives the private owner off the sea or prevents his growth and assuredly prevents new capital from coming into existence, there will be no building by the Government, or anyone else under the American flag, of those types of ships so sorely needed to balance our fleet and to aid our Navy in time of war.

Continued Government operation is a solution only from one standpoint. It solves the problem in one way, to wit, that the fleet shall be operated by the Government until it is worn out and thus assure the elimination of the American flag from world commerce.

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Fast Losing Art of Shipbuilding

With the limitations of armament and the holiday in naval shipbuilding, the development of the private shipyard becomes more essential than ever, or the art of shipbuilding will be lost to America, and in time of war those nations of the world who kept their shipbuilding alive through overseas carrying will have an unmatchable advantage against us. So, with changed conditions from the standpoint of our country's security alone, it is essential that we foster a private merchant marine built by American workmen.

Therefore, with higher costs of living and with higher capital charges, if we grant that for war and peace time purposes we need a merchant marine, the Government must, through aid to shipping, direct or indirect, or both, make good the difference between these added charges under the American and other flags. And further, only through aid to private shipping can we hope to end the great loss through governmental operation now existing and liquidate the Government's fleet.

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Sinister Forces at Work Covertly

We hold no quarrel with the foreigner, who would do all he can to prevent the establishment of an American merchant marine, that the profit of our carriage might inure to him. But we ask that there at least be a public understanding of the sinister forces that are at work—forces that can not be measured, that can not be detected, that can not be cornered—who use their instruments subtly among honest men. The day has come when we must in common understanding, approach this subject. Happily, the Shipping Board, after long and careful study, came to the conclusion that a proper measure of Government aid to accomplish the purposes in mind could only come through the use of both direct and indirect aids, throwing the burden on to the indirect aid.

Combination of Both Methods in Proposed Legislation

Under the chairmanship of Commissioner Lissner, in conjunction with the chairman of the Shipping Board, and aided by an ample staff of experts, the Shipping Board made a study of all forms of indirect and direct aids ascertainable. A plan has been worked out whereby a very sound system of indirect aids is proposed. It is proposed in addition to give direct aid to a sufficient extent to make possible in good years earnings of 10 per cent or more for ships—surely not a

very large earning where capital has to be attracted in competition with other enterprises. Beyond 10 per cent the earnings will be divided equally between the owner and the Government until all of the direct aid shall have been paid back into the merchant-marine fund to be created for the aid of shipping, after which the ships retain all of the surplus earnings, if any. If the indirect aids proposed should be sufficient in any annual period to bring proper returns, there would be no direct aid retained. Thus the burden of the aid is thrown on the indirect.

All Possible Indirect Aids Recommended

Thus the proponent of indirect aids can have no occasion to quarrel with the proposals; for, as the Shipping Board recommends every practical indirect aid possible to give, if those indirect aids should not be sufficient, no one can question that the Government should, from its Treasury, if ships are a national necessity, if the Government's loss in operation is to be ended and its fleet sold, help to the extent of making possible earnings of 10 per cent in good years. The proponents of direct aid certainly can raise no objection to indirect aids being first called into being, reliance being placed on direct aids only if the indirect aids are not sufficient. Therefore, in the legislation proposed by the President to the Congress through the Shipping Board's study, there can be no quarrel between the two schools of Government aid.

No Opportunity for Profiteering

This legislation proposes a very proper profit limitation—10 per cent on the earnings of ships, and after that equal divisions of earnings between the owner and the merchant marine fund until the subsidy is returned. Surely such an allowance of earnings can not be called profiteering, because, while the ships are allowed a net profit of 10 per cent before beginning to return the subsidy, and thereafter are allowed half the net profit until the entire amount of the subsidy is returned, nowhere in the Shipping Board study is it proposed that ships be protected against loss. Under the proposal made, including the right of the Shipping Board to make 10-year contracts, there will be many years during which, with all the aids given, ships will lose money; and it is universally conceded that in the shipping business, through the years of plenty and years of famine, the average that any ship can earn through the proposed Government aid during the term of its 10-year contract is a very modest sum.

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Construction Loan Fund

Section 11 of the present Jones Act provides that for a term of five years the Shipping Board may recover into a construction loan fund $25,000,000 annually, or a total of $125,000,000. Thus far the Shipping Board, like the horse that eats its head off, has used all the money for operation and construction that have come to it from liquidation, and there is nothing in the loan fund. The board, however, hopes with proposed appropriations soon to be made available, to have its debts liquidated at no late date, and asks that it be permitted out of further liquidation to accrue to the construction loan fund as expeditiously as possible the $125,000,000, and begs permission to loan this at rates as low as 2 per cent.

Great Cunarders Virtually Gift

Great Britain, feeling a commercial and naval need for the *Mauretania* and *Lusitania*, built these ships for the Cunard line at an interest charge of 2¾ per cent. However, Britain furnished all the money, gave them 20 years to pay it off, and gave the company an annual subsidy that equaled the amount of interest and amortization to be paid. So

that in effect, the British Government made the Cunard Co. a present of the ships. Nothing so drastic is proposed by the Shipping Board.

Owner Must Do His Part

We propose at most to loan two-thirds of the value of the ships; the balance must be furnished by the owner. The low interest rate will be given only for special types of ships that will be considered essential for the building of a balanced merchant marine for peace and war time purposes, and will be measured with a view to equalizing capital costs. Again, the limitation of profit comes into play; because, if the lower interest rate results in increased earnings at above 10 per cent, half of those increased earnings come back into the merchant marine fund until the subsidy received is paid back in any one year. If the earnings should not be 10 per cent it will be proved that the Government wisely loaned the money at 2 per cent to insure that these types of ships, which are as needed as warships themselves, be built. It is this construction loan fund that is our greatest insurance for continued operation of private shipyards in America.

Income Tax Relief

Another form of indirect aids proposed is in income tax relief. In order to create an incentive for shippers to use American-flag ships and as a stimulus to our foreign trade, a deduction from net Federal income tax payable should be allowed on the basis of 5 per cent of the freight paid on goods imported or exported in American-flag vessels. This deduction in time might amount to eight or ten million dollars per year.

Through co-operation with the Treasury Department and by legislation a greater allowance for depreciation for income-tax purposes should be made on ships in order to make the depreciation allowances more accurately represent the actual depreciation of vessels and to give effect to the marked slump in the value of tonnage during the past several years.

Section 23 of the merchant marine act should be amended so that the payment of all income taxes (which would otherwise be payable on net earnings of vessels in foreign trade) shall be waived by the Government when the amount of such taxes is applied to half the cost of new ship construction—increasing same from one-third as at present.

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Division of Immigration

It is proposed through co-operation with the Bureau of Immigration of the Department of Labor that regulations should be prescribed and legislation enacted that would insure to American-flag passenger ships at least 50 per cent of the immigration coming to this country.

Such regulations shall not go into effect until existing treaties are modified sufficiently to permit. The President is directed to undertake such negotiations as may be necessary, and upon completing such negotiations to proclaim the taking effect of this provision.

Had such a provision been enacted during that pre-war period when immigration was at its height — 1,200,000 per annum—and had half of that number of immigrants come in American-flag ships, the Shipping Board believes that instead of having only 15 passenger ships under the American flag in 1914, in the north Atlantic at least we would have had as many passenger ships of the third-class type as any nation in the world, Great Britain not excepted.

Overlooked Invaluable Immigration Aid

Had we husbanded and used our rights—had we shown the slightest interest in or desire for a merchant marine, without one cent of aid

from the Treasury, through the enactment of an immigration proposal such as here put forth, we had in the flood tide of immigration within our grasp the means of establishing a valuable branch of the merchant marine. Should this proposal work out as the Shipping Board believes it will, the limitation of profits will again come into play, and many of the third-class passenger ships—and better classes of passenger ships for that—will earn over 10 per cent as a result of this immigration legislation. The plus beyond the 10 per cent will be equally divided between the owner and the merchant-marine fund until the subsidy is repaid.

Requires Government Employees to Use American Ships

It is proposed that all Government agents from whatever department who travel abroad make use of American-flag ships. It would appear unseemingly that Congress should have to be petitioned to make such action mandatory by law; but, sad to relate, many if not most of the servants of the Government traveling abroad use the ships of foreign flag, giving oft times as their excuse that they do so as a compliment to the country to which they are going. One has never heard of a foreigner using an American-flag ship as a compliment to us!

To increase the revenues of American vessels and to furnish an example for all American citizens to follow in giving preference to American ships, therefore legislation should be enacted that will prohibit hereafter the overseas transportation of passengers or freight at the expense of the Government other than in a vessel flying the American flag, unless suitable and convenient transportation by an American vessel is not obtainable.

Army Transport Service

Based on current commercial rates and on the volume of passenger and cargo movement for 1921 on trans-Pacific traffic alone, the total charge for transporting Government passengers and cargo by commercial vessels would be approximately, $7,500,000 per annum. There can be no economic justification for the withholding of this business from Shipping Board ships which are available or from privately owned ships. The withdrawal of the army and navy transport services, which the President should be authorized to effect by executive order in whole or in part, will materially reduce the operating losses of the Shipping Board, and should largely aid in the disposal of many of its vessels. It is estimated that during the first year the diversion of this traffic to the trans-Pacific Shipping Board services or to privately owned lines would result in increased net earnings to the Shipping Board or such privately owned lines of approximately $5,000,000. This business would be an impelling inducement to private owners to purchase at a fair valuation the Shipping Board passenger-cargo vessels adapted for this service.

The volume of business afforded to trans-Pacific lines through the army and navy transport service should do much to aid in bringing earnings to 10 per cent, after which half of the earnings will be returned to the merchant-marine fund until the full subsidy is repaid.

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Direct Aid

In its study the Shipping Board has undertaken to make a proposal that shall put American ships on a basis of equality with Great Britain, which has the next highest cost of operation to ours. At no time did we consider aids, direct or indirect, that should do anything for the American owner but place him on a parity with Great Britain. Others will explain to you how we arrive at the basis of direct aid, which may be necessary to take up the slack between the benefits inuring from

the indirect aid proposed, and the amount needed to place costs on a parity with those of Great Britain.

The difference in costs will be not alone that existing at present. Recognizing the imperative need of an American merchant marine in the true sense of the word, the bill provides that no vessel shall receive compensation unless two-thirds or more of her entire crew, exclusive of officers, are American citizens. The officers are required to be citizens by law. The remainder of the crew must be eligible for citizenship, which bars from employment on compensated vessels crews drawn from the so-called Asiatic barred zone. Because of the difficulty of training American citizens to be servants and waiters, the steward's department on passenger ships is exempted from this requirement.

The effect of demanding a fixed proportion of American citizens on board ship and the setting of that proportion at a figure much higher than that which obtains to-day will result in an increased wage differential even beyond that which exists to-day.

Amount of Direct Aid

The direct aid is computed on a differential based on a combination of speed, tonnage, and distance covered, starting with a half cent per gross ton per hundred miles steamed in the foreign trade for ships under 13 knots, and increasing to a total of 2.6 cents per gross ton per hundred miles steamed for ships of 23 knots and over. It is estimated that in order to develop a balanced fleet of 7,500,000 gross tons, which should carry 50 per cent at least of all branches of our overseas trade, the cost to the Treasury will ultimately approximate $30,000,000, though for the first year it is estimated at only $15,000,000.

The details of how this will work out require technical and lengthy illumination, which will later be given you by those who are expert.

Direct Aid Proposed Modest

I wish only to state that from the investigations made by the Shipping Board, we think this sum a very modest one. If it should enable us to soon get the Emergency Fleet Corporation out of operation and save the greater part of the $50,000,000 loss which now burdens the Treasury, the direct aid here proposed should and will more than pay for itself. It is for that reason that we stand firm in the guaranty to Congress that before long the amount paid out in cash subsidy to American ships will be more than equalized by decreased appropriations for the Emergency Fleet Corporation.

It was obviously impossible to compute a basis of Government aid that will be exact. It is no more possible to figure out a system of direct aid for shipping on exact lines than it is possible to enact a tariff bill or a tax bill that will work out with exact justice. When one legislates in the abstract for such vast undertakings, covering differing operations under differing conditions, one can figure at best on the average. But happily in the present proposed legislation, by the limitation on profit in inequalities are equalized in the ultimate.

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National Policy Will Bring New Life

The Shipping Board wishes to emphasize to your committee and to the Congress that world shipping is now more depressed than it has ever been in proportion to world tonnage. Capital is hard to get; operators are timid not only because of the lack of cargoes but because of the uncertainty that hangs over shipping all over the world, through the possible continuous competition in operation of the American Govern-

ment and through the unliquidated tonnage owned by our Government. The greatest stabilizer for world shipping conditions, and particularly for American shipowners and operators, that could come would be the enactment of the legislation proposed by the President that will give a national policy to American shipping, and in behalf of which the Shipping Board is now appearing before you. Courage would immediately come to the American owner, and new life, we believe, would be given to the American investor.

Conclusions

However, so vast an undertaking can not be quickly liquidated. We believe that of the 700 good freight ships we have, the Shipping Board would feel very happy if, within 30 months from the time of the passage of this bill, it could dispose of sufficient ships to take care of the routes it is now operating and put the Emergency Fleet Corporation out of business as an operating company. This, however, the Shipping Board believes is within the realm of promisable accomplishment, and this the Shipping Board believes it can in good faith encourage the Congress to believe will be brought about.

In the human body many organs are vital. Without the heart, the lungs, the liver, the brain, life is not possible. No man can say which is the more vital organ. And so in our national life are many organs vital. Which is the most vital no man can say, but without the possession of any one of the vital organs the Nation can no more live than can the individual. In the development of our national being the merchant marine for peace and war purposes has become a vital organ. Government operation makes that organ a diseased one.

Nation Faces Issue It Can Not Dodge

We are now face to face with the solution of this great national problem. The Shipping Board believes the proposal of the President if adopted by the Congress without major change, will bring to America a healthy organ in a merchant marine, one consonant with our national strength, with our national potentialities, and with our national desires. The salient proposals made are as a mosaic, where each part fits into the other. The Shipping Board stands fast for the general principles covered. But in the application of details, both by law and regulation, the board feels free to say that there may be points that should be further explored and various views that should be considered. Any radical change in the proposals might, however, result in the destruction of the whole.

Urgency of the Situation

For reasons which we have sketched to you, the inefficiencies of the Government operation, the great loss thereby accruing through the continuance of the Emergency Fleet Corporation, the uncertainty in the minds of private owners because of that continued operation, and the need of a policy to insure the disposition of the Government-owned fleet, all testify to the fact that expedition is the essence in the enactment of the legislation for which the President has asked. Delay may be fatal. The Shipping Board would view with alarm inaction by this Congress on the legislation which the President asked in behalf of our merchant marine.

Proposal Nonpartisan—All American

If you accept not our proposal, we join the President in asking that you make a contra one, for, if the status quo remains, we know that as a merchant marine power we shall be bankrupt.

We come before you pleading an all-American question, nonpartisan, with the unanimous recommendation of all the members of our board, Democratic and Republican alike. We come before you to plead that through the enactment of the legislation proposed by the President, America may take its place on the seas as it has won its place on the land. We come before you to plead that an instrument of war be turned into a glorious and profitable instrument of peace, and that we thereby insure to coming generations the heritage which should rightly be theirs.—*Congressional Record*, 27 June, 1922.

HEAVY FUEL COST IS MAIN OPERATING HANDICAP U. S. VESSELS HAVE TO FACE.—Articles recently published in *The Nauticle Gazette* have shown that the high cost of operation of American ships is due more to heavy fuel, upkeep and repair bills than to wages. The high fuel consumption furnishes the item of greatest differential in the operating costs of American and foreign ships and much can be done towards reducing this expense. There are two main reasons why Shipping Board vessels burn more fuel than foreign ships, the first being the poor construction of hulls and machinery, and the second the less efficient manner in which the vessels are handled.

Bows Too Blunt

In the matter of fuel consumption the Board's ships are burdened with an immovable handicap over foreign vessels because of their construction and this handicap can never be entirely overcome by the efficiency of crews. It is woven into the very fabric of the Government's mercantile fleet and in all consideration of competition with foreign ships must be taken into account. The hulls of the Board's ships are too blunt to allow them to make a good speed on an economical fuel consumption, and it often happens that in a head sea the ships will make scarcely any headway despite the amount of fuel that is consumed and the quantity of steam generated. Because of this condition the machinery which should be more efficient than that on foreign vessels because of later design is in reality less effective, and many of the Board's vessels are underpowered.

These factors which result in heavy fuel consumption can be partly removed by competent crews but they can never be entirely overcome and so long as the Board's ships are afloat they must be reckoned with. The other main reason for high fuel bills, however, arises from the human element and it is in this connection that great improvement can be shown. If our ships were handled as efficiently as those under foreign flags the fuel costs would be materially reduced and give our ships a better chance to compete with those of other nations.

In the first place a master should know his vessel thoroughly, but he is rarely on one ship for a long enough period to enable him to understand its peculiarities. One vessel will make a better speed under one trim than she will under another, and the master should be able to have his ship trimmed to the point where she will show the best speed results.

Faulty navigation also adds to the consumption of fuel and this is more common on Government ships than is apparent from the records. For instance, assume a ship is on a course of a thousand miles it frequently happens that poor steering will send her on a zig-zag course. The master takes his position every twenty-four hours and calculates it on the basis of the nearest distance between two points. Therefore he shows a straight course when as a matter of fact the vessel has travelled over a curved course and in the calculation of distances no account is taken of the irregularity. Thus over the course of the thousand miles the ship may actually have travelled twelve or thirteen hundred miles but the extra distance is not shown on the ship's log. Therefore the ship burns more

fuel than is actually necessary to cover the thousand miles and the records of the voyage will naturally show a heavier fuel consumption than they would if the ship kept strictly on her course.

Steering on Alien Ships

On a foreign ship the master is very particular to see that his helmsman keeps the vessel close on her course, but this can only be accomplished by men of wide experience. This better steering is reflected in the fuel consumption of the vessel, and it is in this connection that competent crews can help to reduce the fuel consumption costs on American ships.

Better steering can be accomplished by a more strict observance of the difference between the navigating compass and the steering compass. The steering compass is located in the pilot house and because of the magnetic influences with which it is surrounded it is rarely correct. There is always a difference of several degrees between the steering compass and the navigating compass, the latter being correct. Therefore the difference should be carefully watched and the one checked with the other. On foreign vessels the two compasses are compared at frequent intervals during the day and the difference allowed for in keeping the ship on her course. On American ships, however, this is not done as often as it should be, and by placing sole reliance upon the steering compass the master will find his vessel going out of her course.

Greater attention should be paid to steering, for faulty steering results in high fuel bills. The master of a foreign ship takes pains to watch the wake of the ship and he uses every precaution to see that the ship is kept on her course. If similar care were taken on American ships a substantial reduction in operating costs would be noticed.

In foreign countries shipowners encourage their crews to keep down costs by awarding a bonus for meritorious work in this direction. It is to the master's financial advantage to save money for the owners and he strives in every way to cut down expenses. When the ship's earnings are calculated at the end of the year the bonus is given in accordance with the showing made. In this country, however, the feeling is too prevalent that when a man obtains his master's license he is at the top of the ladder and there is nothing left for him to do. American shipowners should encourage their officers to keep up their studies, and reward them for good work. In this way crews will become efficient and the operating costs of our ships will be reduced to such a degree that they will be able to compete sucessfully with foreigners for a fair share of the world's trade.—*The Nautical Gazette*, 17 June, 1922.

ENGINEERING

TAMED LIGHTNING.—By means of a special apparatus which reproduces actual lightning and is known as a "lightning generator," the laboratory of Dr. Charles P. Steinmetz, chief consulting engineer of the General Electric Company, is making the most successful tests of lightning arresters that have ever been conducted.

The artificial lightning which Dr. Steinmetz and his laboratory coworkers, J. L. R. Hayden and N. A. Lougee, have succeeded in producing for these purposes, has about one five-hundredth of the horsepower possessed by the lightning flash of nature. It has only one five-hundredth as much voltage. But except in the matter of magnitude it is exactly the same sort of energy, stored up and discharged in the same way, as is the gigantic lightning bolt of an electrical storm in the heavens.

Any object that is placed in the path of the artificial lightning stroke is torn to pieces just as truly as it would be if it were in the path of natural

lightning. The laboratory bolt has shattered blocks of wood and small tree branches, scattering them in all directions.

The object is exposed to the lightning by being physically connected to the wiring which is used as the directive path of the man-made lightning. A nail is driven into each end of the wood, and the wires are wound around the nails, so that the block hangs suspended in the circuit through which the lightning will travel.

When lightning arresters are tested by this imitation thunder-storm machine, they are connected up in the same manner, so that the lightning will affect them in the same way that natural lightning would. They are also connected to the lightning circuit of the building, so that they are in effect protecting the lighting circuit against a bolt of laboratory lightning, just as in actual service they would be called upon to guard a transmission line against natural lightning.

Valuable discoveries have been made by this means in the behavior of lightning arresters in service, because by means of the lightning generator, lightning can be duplicated on a small scale at will, and also can be controlled and experimented with. Unusually severe service conditions can be produced, and the action of the lightning arresters can be observed with accuracy. It has been found that the causes for the occasional failure of lightning arresters to function in actual use are far different from what has heretofore been imagined.

In the artificial lightning stroke, a voltage of 120,000 volts was chosen as most convenient. The voltage of the lightning flash of a thunder-storm has been estimated by Dr. Steinmetz at fifty million volts.

The artificial lightning represents, while it lasts, more than a million horsepower. The estimated horsepower of a natural lightning flash is given as 500 million horsepower. The million horsepower of the man-made lightning, like the 500 million horsepower in nature's lightning, would not be very useful for practical purposes, because it lasts such a brief instant. It lasts about a hundred thousandth of a second.

It is true, the natural lightning flash has about 500 times as much horsepower. The difference in energy therefore appears colossal. But the difference in the nature of its action and effects is practically zero. Only, while Nature's lightning shatters and tears a whole tree, the man-made lightning does the same with a piece of a smaller tree.

And yet, according to the laboratory specialists, it is theoretically possible to construct an apparatus which would reproduce Nature's lightning in all its magnitude. It would not be practical to do this, for it would mean apparatus of stupendous size and complexity; and it would not be desirable, as it would not be safe to approach near enough to watch it. But the same applied principle would operate as in the case of the lightning generator now in successful use.

This generator consists essentially of a high voltage condenser of large capacity in the form of 200 large glass plates. These are arranged in groups of fifty and in two banks, or rows. The rectified direct current is stored up in these condensers, which are connected up so as to be capable of holding 120,000 volts.

One end of the double row of condensers corresponds to the thunder-cloud in the sky, in which an electric charge is gradually stored up and increased by the conglomeration of the rain drops, as Dr. Steinmetz has shown. The other end of the condenser plates corresponds to the earth.

When the tension of the stored-up electric energy becomes greater than the lightning generator will hold—and the tension which it will hold is 120,000 volts—or, in the case of natural lightning, becomes greater than the thunder-cloud will hold, whatever the amount of tension may be, the discharge takes place. The lightning flash is seen, the thunder rolls—

represented, in the case of the lightning generator, by a loud snapping sound—and the bolt strikes.

"Higher voltages than we use in this generator have been produced," said Dr. Steinmetz, "and have been talked about as 'lightning.' But mere high voltage is not lightning and has no similarity to lightning in its action and effects. The characteristic of lightning is high voltage backed by large power, lasting for a very short time and so giving explosive effects.

"In the high frequency experiments of Prof. Thomson, Telsa and others, the voltage was very high, but with little power back of it; and even with a million volts, at Pittsfield, the current was a fraction of an ampere. Thus the explosive effects characteristic of lightning were entirely absent.

"In our lightning generator, we get a discharge of ten thousand amperes, at over a hundred thousand volts, that is, a power of over a million horse-power lasting for a hundred thousandth of a second. This gives us the explosive, tearing and shattering effects of real lightning, so that, for instance, a piece of a small tree, exposed to the discharge, is torn to pieces. A piece of wire struck by it vanishes in dust.

"The difference is similar to that between a pound of dynamite and a pint of gasoline; the pint of gasoline contains more energy and can do more work; but the pint of gasoline gives off its energy only slowly, at a moderate rate of power, while the pound of dynamite gives off its energy explosively, all at once, at an enormous rate of power."

The surprising advance of electrical science which these things indicate was pointed out by Dr. Steinmetz.

"When Edison ran his first circuits for electric lighting, in New York City, he used 220 volts. Today we are sending electric power across the country at 220,000 volts. Thus, in 40 years since Edison's first installation, we have increased the voltage in our electric circuits a thousand-fold; we have produced and played with a million volts, and the voltage of the thunder-cloud is only 50 times higher than what man has produced. So, you see, the step from the highest voltage now used to that of lightning is less than was the step which the electrical industry has taken in 40 years."—*Scientific American*, July, 1922.

COMPARATIVE TESTS ON COAL AND OIL BURNING BOILERS.—Recently, comparative tests were made on two small boilers at the National Pipe Bending Co.'s plant in New Haven, Conn., for the purpose of ascertaining the relative cost of generating steam by oil and by coal. The boiler installation at the plant consists of two Bigelow horizontal return-tubular boilers of identical design, each having 1,268 sq.ft. of water-heating surface, the one equipped to burn fuel oil, the other coal (hand-fired).

The results are interesting because they show that in a small plant producing about 4,000 lb. of steam per hour for a period of ten hours daily, oil can be burned as economically as coal. If the load fluctuates considerably, there may be a substantial saving by the use of fuel oil. In the case in question only one boiler is in use at a time. The cost of labor, therefore,

TABLE I. REPORT OF TEST ON BOILER USING FUEL OIL

Number and kind of boilers	One horizontal return-tubular
Water-heating surface, sq. ft.	1,268
Duration of test, hours	7
Steam pressure by gage, lb. per sq. in.	77
Temperature of feed water entering boiler, deg. F.	206
Temperature of escaping gases leaving boiler, deg. F.	492
Force of draft between damper and boiler, in. of water	0.13
Oil fired per hour, lb.	304
Weight of water fed to boiler per hour, lb.	4,000
Equivalent evaporation per hour from and at 212 deg., lb.	4,150
Equivalent evaporation per hour per square foot water heating surface, lb.	3.27
Water fed per pound of oil, lb.	13.1

Equivalent evaporation per pound of oil, lb.	13.6
Calorific value of one pound of oil, B.t.u.	18,520
Efficiency of boiler and furnace, per cent	71.5
Flue-gas analyses (average), per cent by volume:	
(a) Carbon dioxide (CO_2)	9.9
(b) Oxygen (O_2)	6.5
(c) Carbon monoxide (CO)	0.0

Cost of Steam Generated by Oil

Total steam used for auxiliary purposes incident to operation on oil, lb. per hr.	285
Weight of water fed to boiler, lb. per hr.	4,000
Steam available for other uses, lb. per hr.	3,715
Oil used, lb. per hr.	304
Cost of oil per lb., cents	0.636
Fuel cost of steam available for plant use, including feed-water pump, cents per 1,000 lb.	52.1

does not enter into comparison, because in this particular plant it is possible to combine the functions of the engineer and fireman in one man, whether coal be burned or oil. If the plant were twice as large, so that it became necessary to employ an extra man as fireman when coal was being burned, the saving by burning oil would be greater, for when oil was being burned this extra man could be released and the entire plant cared for by one combined fireman and engineer as before.

Fuel oil is delivered to the plant in tank cars equipped with heating coils. Before the oil can be pumped from these cars, it must be heated for about twelve hours by passing live steam through the coils. At the end of this time the oil is sufficiently fluid to be pumped in the yard storage tank. Here again live steam must be used to keep the oil at a moderate temperature to facilitate pumping the daily supply from the storage tank to a service tank within the power plant. The same pump that empties the tank car into the storage tank also fills the service tank from the storage tank.

A second steam pump, located in the power house, supplies the burner with oil from the service tank. The heat in the exhaust from this pump is utilized to give the fuel a final heating on its way to the burner. The service tank is equipped with heating coils, and a certain amount of steam is used each day in these. Moreover, steam is used by the oil burner to atomize the fuel.

Before a fair comparison of the two boilers could be made, it was necessary to determine how much steam was used for pumping, heating and atomizing the oil. The quantity of steam used by the feed pump does not enter into the comparison, as this is constant for a given load irrespective of what fuel is used.

All the various quantities of steam used for auxiliary purposes when burning oil, were either measured or estimated from the best available data, and from them a figure was obtained that represented the number of pounds of steam for all auxiliaries (except the feed pump) chargeable to each hour's operation of the oil-burning boiler. This figure was then subtracted from the hourly evaporation of the oil-burning boiler. From the fuel consumption and the cost of the fuel the cost of steam per thousand pounds was calculated to be 52.1 cents for oil, and 55.7 cents for coal. Although these figures are close, the advantage of cleanliness and flexibility which the oil-burning system possesses turns the balance clearly in favor of oil.

The low efficiency of the coal boiler will be noted. This is largely accounted for by imperfect combustion, indicated by the presence of CO in the flue gas. Since the load fluctuates between comparatively wide limits, it is necessary to change the draft frequently. Thus it is impossible to maintain for very long the best conditions of combustion. It is therefore not unreasonable to find an efficiency considerably lower than if the boiler

TABLE II. REPORT OF TEST ON BOILER USING COAL

Number and kind of boilers	one horizontal return-tubular
Water-heating surface, sq. ft.	1,268
Grate surface, sq. ft.	33
Distance from gate to nearest heating surface, ft.	2.59
Duration of test, hr.	9.83
Steam pressure by gage, lb. per sq. in.	78
Temperature of feed water entering boiler, deg. F.	212.0
Temperature of escaping gases leaving boiler, deg. F.	524.0
Force of draft between damper and boiler, in. water	0.21
Weight of coal as fired, per hour, lb.	529
Water evaporated per hour, lb.	3,910
Dry coal per hour, lb.	508
Percentage of ash and refuse based on dry coal	6.2
Equivalent evaporation per hour from and at 212 deg. lb.	4,050
Equivalent evaporation per hour per square foot of water heating surface, lb.	3.2
Water fed per pound of coal as fired, lb.	7.41
Equivalent evaporation per pound of dry coal, lb.	7.96
Calorific value of one pound dry coal, B.t.u.	14,722
Efficiency of boiler, furnace and grate (dry coal), per cent.	52.6
Coal analysis, per cent:	
(a) Moisture	3.95
(b) Volatile matter	17.4
(c) Fixed carbon	73.4
(d) Ash	5.23
(e) Sulphur (separately determined)	0.51
Fluo-gas analysis (average), per cent by volume:	
(a) Carbon dioxide (CO_2)	11.4
(b) Oxygen (O_2)	6.8
(c) Carbon monoxide (CO)	0.44
Cost of Steam Generated by Coal	
Water fed to boiler, lb. per hr.	3,910
Coal used per hour (as fired), lb. per hr.	529
Cost of coal, cents per lb.	.4125
Fuel cost of steam, cents per 1,000 lb.	55.7

were operated at constant load. In the case of the oil-fired boiler closer regulation can be effected, and fluctuations in the load can be met with less sacrifice of efficiency than is possible with coal.

These tests, the principal results of which are shown in the tables, were carried on by graduate students of the Sheffield Scientific School under the supervision of Professors Dudley and Lockwood, of the school.—*Power*, 13 June, 1922.

THE "MAJESTIC" AND THE "MAURETANIA."—During the month we described the new White Star liner *Majestic*, and gave some particulars of her machinery. Additional interest now attaches to this vessel on account of the fine performance she made on the homeward run of her maiden voyage, which ended on her arrival at Southampton on Saturday last. Her speed average over five hours on one day was 27 knots, and throughout the whole of a day she made an average speed of 23.59 knots. It is true that these results, good as they are, do not surpass the performance of the Cunarder the *Mauretania*, which, on her recent record run, made an average speed across of 26 knots and maintained 27.04 knots during one day; but they do show that the *Majestic* is capable of splendid steaming. We believe that in designing and in building the largest ship in the world it was the intention of her original builders and owners to make her unique not only in size but also in speed, with a view to regaining for Germany the Blue Riband of the Atlantic, which had been won by the Cunard liners *Lusitania* and *Mauretania*. For the *Majestic's* large displacement of 64,000 tons, her normal turbine rating of 66,000 shaft horse-power is on the conservative side, perhaps, and it would certainly appear from the maiden voyage and the voyage from Cuxhaven to Southampton that, without pressing, her machinery is capable of a larger output. As yet the *Majestic* is a new ship, but there is little doubt that when her engineers are fully conversant

with the capabilities of her boilers and turbine plant, the present excellent performance will certainly be improved upon.—*The Engineer*, 2 June, 1922.

VOYAGE AROUND THE WORLD OF MOTORSHIP "WILLIAM PENN."—On March 19 the *William Penn* completed her maiden voyage around the world of 28,500 miles. She is the first large American motorship suitable for deep-sea cargo trade. On her return to New York the propelling machinery was found to be in perfect condition, requiring no repairs. The exhaust and inlet valves of the main engines were changed only once, which was at the middle of the voyage. All work on the main engines was done by the engineer personnel when in port and all similar work on the auxiliary engines and machinery was done while under way at sea. There was no involuntary stopping of the vessel at any time throughout the voyage.

The two main engines are six-cylinder, 29⅞ in. by 45¼ in. They were originally designed to run at 115 r.p.m. and deliver together 4500 i.hp., but because of the full form of the *William Penn* the power was cut down by reducing the revolutions to 108, corresponding to an output of 4200 i.hp. and a speed of 11.5 knots. In addition there are three auxiliary Diesel engines each direct-coupled to a 65-kw. generator for supplying current to the various electrically driven engine-room and deck machinery. At sea only one of the auxiliary engines was required and carried a load of about 55 kw.

The mean speed from New York to London was 11.01 knots with a mean fuel consumption of 13.06 tons per day (exclusive of donkey boiler). The longest non-stop run was from Singapore to Suez, 4943 nauctical miles, taking nearly 18 days with a mean sea speed of 11.48 knots and mean total consumption of main and auxiliary engines of 13.41 tons per day, equivalent to a consumption per indicated horsepower of 0.3025 lb.

The original article gives a comparison between the *William Penn* and the electrically driven ship *Eclipse*, which, while not entirely strict, appears to be in favor of the motorship. It is also pointed out that there are several sister ships of the *William Penn* equipped with either steam turbines or reciprocating engines which have been laid up for the past year or more due to their inability to operate at a profit, while the *William Penn* sailed in April for the Far East again, carrying chiefly heavy or dead-weight cargo consisting mostly of structural steel and loaded down to the full-draft marks. With this class of cargo she is able to carry about 1000 tons more than an equivalent steamer, this amount representing the additional fuel and fresh water which the steamer has to carry.

On the way out the vessel encountered severe storms, and it became necessary to slow down to prevent losing the deck cargo. On the return trip the vessel was not fully loaded, although the cargo was of a bulky nature, consisting of hemp, copra, rattans, tapioca, coffee, etc. (*Marine Engineering and Shipping Age*, vol. 27, no. 5, May, 1922, pp. 313-314, 1 fig., *dc*)

AERONAUTICS

THE AIRSHIP AS NAVAL AUXILIARY.—In two interesting articles published last week *The Morning Post* discussed the airship problem with special relation to national defence, endeavoring to show that large dirigibles filled with non-inflammable gas may play a highly-important part in future naval warfare. The argument was developed with great ingenuity, and a vivid picture was drawn of the terrible damage that could be done to our shipping by a fleet of hostile airships working in conjunction with flotillas of ocean-going submarines. The writer asks us to visualize a convoy of troopships crossing the Atlantic in some future war. Owing to the tremendous range of visibility which an airship commands when at

high altitudes the convoy, it is argued, could not long escape detection, and once it had been sighted the airships would call up their submarines and proceed to make things lively for "the doomed vessels crawling along at 15 knots." They would first be attacked under cover of smoke-screens by torpedo-dropping planes, the ships so disabled being finished off by the lurking submarines.

Such a scheme looks plausible enough on paper, but we venture to doubt whether it would prove workable in practice. In the first place, airships are, and apparently always will be, too dependent on weather conditions to justify their being cast for any important rôle in a war operation which is to be carried out on a certain date which must necessarily be fixed sometime beforehand. Secondly, although an airship filled with non-inflammable gas might be more difficult to destroy than were the Zeppelins during the late war, it would still remain very vulnerable to the light shell guns which are already carried by the larger types of aeroplane. An important convoy of troopships would certainly be provided with aircraft-carriers, whose planes would give an uncommonly warm time to any airship that ventured to approach; while hostile submarines would be attended to by the convoy guard of destroyers and other fast vessels, armed with depth charges and all the other anti-submarine devices which proved so effective against the German U-boats. The argument that large airships, being capable of rising to heights unattainable by aeroplanes, will have little to fear from attack by the latter, is not convincing, for it was repeatedly proved during the Great War that the nominal maximum ceiling of an airship could only be achieved under ideal atmospheric conditions, and as a general rule aeroplanes were able to outclimb the largest Zeppelins. Evidence recently published in Germany goes far to confirm the impression that the German airships, at any rate, failed to make good as instruments of war, and few will deny that Germany was and still is far ahead of all other countries in the development of the lighter-than-air craft.

In the latest number of the *Marine Rundschau* there is a detailed account of the creation and war work of the German Navy's Zeppelin fleet, from which it appears that, apart from those used in training purposes, there were in all 72 airships under the control of the naval authorities, 22 of which were simultaneously available in 1915, 31 in 1916, 39 in 1917, and 23 in 1918. This aerial fleet was apparently used with great skill and vigour, yet it had no perceptible influence on the course of the war, and admittedly failed to justify the enormous expenditure of money, man-power, and material which its upkeep involved. The *Marine Rundschau* confesses that by 1918 the war value of the Zeppelin had sensibly declined. Not only had raids on England grown too hazardous to be attempted, but at the same time airship reconnaissance over the North Sea had become exceedingly dangerous by reason of the speedy and fast-climbing aeroplanes carried in British warships. The *L-70*, which was specially designed to cruise at an altitude of 23,000 feet, was shot down in flames by British warships on her maiden flight, the atmospheric conditions having been such that she could not maintain her maximum ceiling. In proportion to its numerical strength the casualties of the German airship fleet were colossal. Of the 72 vessels employed for active war work, 26 were destroyed by enemy action, 14 by bad weather, and 12 by accidental explosion. In the light of Germany's experience its seems to be established that the large rigid airship has a war value too limited to justify the perpetuation of the type, and while we agree that the development of airpower is a question of vital importance to this country, we should be sorry to see any part of the meagre funds now available for defence diverted to the creation of an auxiliary airship fleet.—*The Naval and Military Record*, 31 May, 1922.

INTERNATIONAL AIR FLEETS.—Although the Washington Conference did not lead to the imposition of restrictions on aerial armaments, it is known that this question was considered by a sub-committee which compiled a series of tables showing the authorized and actual strength of the great Powers in airships and flying machines on October 1, 1921. According to these tables Great Britain, on the date in question, had the following heavier-than-air craft in service:

Pursuit or combat 'planes	93
Attack, bombing, or torpedo 'planes	266
Observation, spotting, photographing, artillery, control, and infantry contact 'planes	236
Long-distance observation or scouting 'planes	99

Additional to these were machines used for training purposes, the inclusion of which gave the following totals in each of the above-mentioned categories: 117, 349, 48, 394, 140, or a grand total of 1,048. The number of French machines returned as available on the same date was 1,722, while the United States was credited with 537, Japan with 537, and Italy with 494 machines, the sum total of heavier-than-air craft at the disposal of the five great powers being thus 4,338.

French superiority was especially marked in combat 'planes, of which she had three times as many as Great Britain, and in observation planes, in which she outnumbered us by more than five to one. The comparatively small number of machines returned for the United States is rather surprising, though it must be remembered that, owing to the wide development of civil aviation in that country, the American air service could be largely reinforced in the event of war by commerical machines adapted for military work.

RELATIVE STRENGTH IN PERSONNEL.— As regards active personnel, the tables give the following totals of officers and men employed in the various air services:—

Great Britain	28,860
France	28,400
United States	12,443
Italy	6,330
Japan	520

The smallness of the Japanese total is probably due to the fact that the majority of officers and men engaged in air work are included in the personnel establishment of the army and navy. Assuming the foregoing statistics to be correct, it will be seen that Great Britain as recently as eight months ago maintained the largest air force in the world so far as personnel was concerned, though France had nearly 75 per cent. more machines.

Since then, there is reason to believe, the relative position of the two countries has undergone a considerable change, reductions on our side and increases on the French having given the latter a big lead in personnel, and a still more predominant position in respect of material. According to the Washington return, we had 545 machines of various types ready for home service last October, but it may be doubted whether anything like this number is effective to-day, as it was admitted in Parliament a few weeks ago that the force available for home defence was limited to 12 skeleton squadrons.—*The Naval and Military Record*, 31 May, 1922.

BOMBING OF DUMMY BATTLESHIPS.—The Air Service Detachment, consisting of two officers and 83 men, arrived at Mitchel Field on May 4, from Germany. This detachment was apparently assigned to Mitchel Field to be broken up and the personnel distributed to other Air Service stations.

This fact is regretted very much by Mitchel Field, because it is found that the detachment contains some very excellent soldiers and mechanics. The officers reporting with the detachment 1st Lieuts. Dogan Arthur and Russell M. Greenslade, A.S., have been ordered to report to Langley Field and Kelly Field, respectively.

In the course of dummy bombing demonstration given on Memorial Day Lieut. Victor E. Bertrandas hit the "battleship" Rock-and-Rye from an altitude of 3000 ft. three times. He was not unduly elated when he descended, however, for Rock-and-Rye was the name given to a warship model of wood and canvas, 25 ft. long, which served as a target.

At 2500 ft. Lieutenant Bertrandas missed the Rock-and-Rye by 100 ft. He mounted to the 3000-ft. level and dropped five more bombs, the first three of which landed fairly on the target, which burst into flames. A brisk wind was blowing at the time. Lieut. L. V. Beau was pilot.—*Aviation*, 19 June, 1922.

NAVY'S OWN AIRSHIP UNDER CONSTRUCTION.—"Made in America" ought to be stamped all over the envelop of the navy's own airship *ZR-1* when the giant rigid craft is completed at Lakehurst, N. J. For in design, structure, material and gas, this ship will be all American. Her characteristics necessarily will suggest the German dirigibles, but in every other way the *ZR-1* will be all our own. Work is now going on in earnest on the fabrication and erection of the airship. The fabrication has been one of the activities of the huge naval aircraft factory at Philadelphia for more than a year and now, after the most rigid and exhaustive tests of all elements of the framework, the duralumin members are being shipped to the hangar at Lakehurst, the largest building of its kind in the world. Here they are being assembled into the pioneer rigid airship to be built in this country.

Called the *ZR-1*, the ship has no connection of any kind with the unfortunate *ZR-2*, destroyed in England. The *ZR-1* is a smaller ship than the British-built craft which cost the navy so many valuable lives, and she is American designed as well as built. Her size and characteristics are based on measurements and data from the German rigid airship *L-49*, which was brought down intact in France during the World War. This was one of the Germans' most famous ships and her type was not replaced after her first trials, but was retained as the standard for further additions to the German airship fleet. Based on this type of rigid craft, and still further improved on the latest data of German rigid practice, tested at each step in construction, and inflated with the non-inflammable helium gas when completed, the *ZR-1* unquestionably will be the most dependable rigid airship ever constructed.

The *ZR-2* was of 2,750,000 cubic feet gas capacity. The dimensions of the *ZR-1* are 680 feet length, 78½ feet diameter, 93 feet height over all, and her capacity will be 2,100,000 cubic feet.

Behind all this activity has been American industry working with the navy in every way. The design and erection of the buildings called for hearty co-operation by construction and building specialty concerns, otherwise the hangar would not have been possible, and its vast size would have been a menace instead of a practical solution of the airship housing problem. For only with the solution of the almost instantaneous manipulation of the thousands of square feet of windows, which allow all gas to escape with the entering draft, and ventilating the shed throughout its entire space, could this shed be successfully used for the purpose.

The sash, operating devices and the colored glass to break the sun's rays in this great building were designed, built and erected by the Detroit Steel Products Company working with the navy. Similarly, other features

Photo International

ON THE GROUND

"LIFTING OFF"

Henry Berliner's Latest Helicopter, on the Ground and "Lifting Off," Which Was Demonstrated Last Week at College Park, Md., to a Naval Technical Commission Headed by Commander J. C. Hunsaker.

of the hangar and mooring mast were designed and built by other American firms. This hearty team work has been responsible for the present status of the *ZR-1* more than any other factor in the enterprise.

This co-operative phase of the building of the *ZR-1* and the Lakehurst plant has been of the utmost value to aeronautical progress in this country. So great an interest has been aroused throughout the world, and especially in the United States, in rigid airships that the Aluminum Company of America has started work on a new plant at Pittsburgh for the rolling and shaping of duralumin for airships. Successful work has been done on drawing duralumin tubing, never before produced outside of Germany, and the various interests contemplating the building and operation of rigid airships in America, or throughout the world, may now purchase their materials in the United States. This is one of the great accomplishments that has come out of the navy's noteworthy enterprise in airship development, and it demonstrates that however deplorable was the loss of forty-four Americans in the *ZR-2* disaster, yet the airship as part of the fleet must be provided and that it is the duty of the navy to do its utmost to keep more than abreast with world advancement in these great carriers of the air.

The Navy department deserves great praise for building the *ZR-1*, which undoubtedly will contribute immeasurably to encourage the investment of private capital in rigid airship construction and thereby promote all those benefits to the nation which but await that magic touch.—*U. S. Air Service*, June, 1922.

THE BERLINER HELICOPTER.—The report, authenticated by photographs which dispel any doubt, that the latest Berliner helicopter has actually flown in a horizontal plane, will come as cheering news to those whose faith in the ultimate success of the direct lift machine has not been dimmed by the arduousness of the task.

As we said some time ago, several helicopters have lifted off the ground and have hovered, but an authentic instance of a controlled horizontal flight was yet lacking. Owing to the methodic efforts of Emile Berliner, the inventor, and of his son Henry, who tests the elder Berliner's machines in flight, we have come considerably nearer the solution of the helicopter problem. This problem is primarily one of stability, and secondarily one of propulsion. To solve the former Mr. Berliner devised a series of vertical vanes, controlled by the pilot, whereby, a given portion of the propeller disk area can be blanketed, which introduces a restoring couple. For horizontal propulsion a separate propeller, inclined to the path of flight, is mounted aft on the fuselage, and is apparently gear-driven from the engine. The entire arrangement is very neat for an experimental machine and further trials of the Berliner helicopter will be watched with interest.—*Aviation*, 26 June, 1922.

THE BRENNAN HELICOPTER.—Some months ago the British Ministry of Munitions announced that it would award a prize of £50,000 to the constructor of a helicopter capable of the following performance, carrying a pilot and one hour's fuel: first, rise to 2,000 ft. height; second, hover without any horizontal motion for half an hour in any wind up to 20 m.p.h.; and third, fly horizontally at a speed of 60 m.p.h.

These requirements are vastly in excess of anything that has hitherto been achieved with "direct lift" machines. As a matter of fact, with one known exception no helicopter has risen from the ground above fifteen or twenty feet, or hovered. The one exception known is that of the Austro-Hungarian *Captive* helicopter, built during the late war by Captain Petroczy, Prof. Karman and Herr Zurovec, which made a number of successful

ascents and on one occasion reached a height of 160 ft. An exhaustive investigation made of the subject by Prof. Karman shows that satisfactory stability is extremely difficult to achieve in a helicopter, and it was to simplify the problem that the Austro-Hungarian helicopter was made captive. The trials demonstrated, what was expected, that when the mooring cables were taut, the helicopter would be stable; but as soon as any slack appeared the machine would assume an oscillating motion.

In view of all the above it comes as a distinct surprise to read in the New York *Times*, in an exclusive dispatch from London, that Louis Brennan, inventor of the gyroscope, and of the torpedo which bears his name, "has gained fresh laurels by completing experiments with a helicopter which is understood to *meet fully the conditions laid down by the British Air Ministry* for a machine of this type."

Subsequent dispatches, however, seem to modify this news. It appears now that Mr. Brennan has not yet made free flight tests with his machine, but bases his hopes chiefly on experiments conducted with scale models. In fact, the Brennan helicopter has not as yet been tested outside of the hangar in which it is housed.

The prominence which the New York *Times* has given this report shows to what extent the idea of "vertical flight" appeals to public imagination, and at that mostly on the fanciful ground that it will enable aircraft to land on house tops. It would be desirable that soaring experiments obtain the same amount of publicity—but judging from the way in which Harth's great 21 min. flight was treated by the press this hope seems little founded.—*Aviation*, 12 June, 1922.

HELIUM AND THE ZR3.—The report that the U. S. naval airship *ZR3*, now under construction in the Zeppelin factory at Friedrichshafen as a "reparation" ship, is to be filled with helium for her transatlantic journey, is interesting news.

On one hand the mere fact that the navy intends to ship to Germany an amount of helium sufficient for inflating the big rigid airship, which is about 2,400,000 cu. ft. capacity, should be a convincing answer to those who still entertain doubts about the reality of helium production in this country. The opinion seems to be generally accredited abroad that American helium production is something in the nature of an interesting experiment rather than an accomplished industrial process. In particular, the actual amount of helium produced in this country for aerostatic purposes is a matter of speculation by many foreign lighter-than-air men. Thus, the opinion is often expressed that had we had sufficient helium for inflating the *Roma* we certainly would have done so—thereby preventing the loss of that fine ship and of its skilled crew.

Without going into the merit of this argument, the fact remains that at the time of the *Roma* disaster there was enough helium on hand to fill a ship the size of the *ZR3*, which gas had been extracted at a cost of about 13 cents per cubic foot. In comparison with hydrogen, which costs from one-half to one cent per cubic foot, the production of helium may seem a costly undertaking. As a partial insurance against fire hazard, it cannot be said, however, that this is paying too much for it, the more so as reasonable hope exists of reducing the production cost of helium to at least one-half, and possibly one quarter, of what it is today.

To achieve such a result further experimentation is needed. The helium maintenance fund of $400,000 asked for by the Chief of Naval Aeronautics at the recent hearings of the Senate Appropriations Committee, should, with a like sum provided by the Army Air Service, make this possible in addition to keeping the Fort Worth plant in operation at full capacity. At the present time this plant has a production of from 10,000 to 12,000

cu. ft. of 95 per cent purity per day, which seems inadequate in case the army and the navy should fill all their ships—including the *ZR1* and the *ZR3*—with helium. With the necessary appropriation, which was lacking last year, the Fort Worth plant should be able to produce almost 40,000 cu. ft. per day, an amount which should suffice for present requirements.

In view of the important role that will devolve upon airships in both the commercial and the military, or rather the naval, fields once the use of helium and heavy-oil engines will have eliminated the fire hazard, it is to be hoped that Congress will not reduce the amount asked for by the Chief of Naval Aeronautics for the maintenance and development of helium.—*Aviation*, 19 June, 1922.

SERVICE TESTS OF LAUNCHING CATAPULT.—Naval officers attached to the Bureau of Aeronautics are greatly pleased with the successful launching of the Service type seaplane, carrying a pilot and passenger, from an airplane catapult on the deck of the U. S. S. *Maryland* at Yorktown, Va., May 24.

The project of catapulting planes from a ship was first effected in 1915 on board the U. S. S. *North Carolina*, followed in 1916 by further experiments on the U. S. S. *Huntington*. The equipment used in those days was, however, too cumbersome and not sufficiently powerful to suit the needs of fighting ships and modern high speed planes. Consequently work was begun to produce a more compact and powerful mechanism which would perform that military function which even at that time it was evident would become an essential part of the duties of a man-of-war—the launching of protective and observation aircraft from its deck. The war, with its insistent demand for quantity production of patrol seaplanes for anti-submarine work curtailed experiments on this project, and it was not until last spring that the work, of which the successful performance of the 24 was the result, was started.

This device gives the United States a point of superiority over every other navy in the world in that none of them are in possession of an apparatus of this sort.

It is the intention to equip every vessel of the battle fleet with a catapult and fighting planes. The bombing operations carried on last summer by the joint forces of the navy and army showed the possible vulnerability of warships subjected to aircraft attack, and the lesson learned from these tests has taught us that the only answer to bombing and air attacks is the use of aviation itself, that is to say the carrying of fighting planes on all types of ships.

Almost eighteen years ago, Samuel Pierpont Langley, Secretary of the Smithsonian Institution, who had already demonstrated the practicability of mechanical flight, using an overhead launching device to start his steam and gas driven models, was nearly ready to undertake the launching of his man-carrying machine. On Oct. 7 and again on Dec. 8, 1903, he made two attempts to launch his large gas-engined, tandem "aerodrome" as he called it, but on both occasions he was unsuccessful, as the plane fell into the water almost before it was free of the launching ways. Later it was found that on each attempt some almost trivial accident happened, once a dragging part interfered with the release at the end of the track, while on the other occasion a guy post forward struck some object on the ways and the machine again plunged into the water, giving the observers a thrill and Charles M. Manly, the pilot, a ducking.—*Aviation*, 12 June, 1922.

ORDNANCE

TRAINING OF SPOTTERS.—With the aid of battery of 3-in. guns mounted on Rosa Island, the training of naval spotters at Pensacola, Fla., is now

carried on with increased efficiency according to a report from the Commandant of the Naval Air Station, Pensacola.

Spotting practice is considered one of the principle duties of a naval aviator in connection with the observation and control of fire from the fleet. His is an unique position, high above the scene of the capital ship in action, where he can view the splash of his ship's salvos, and judge the needed correction to bring the shells on the enemy fleet. Today student aviators are sent aloft at Pensacola in standard spotting planes, while the battery on shore fires at one or more targets out at sea. Observing the splash of the 3-in. guns, which reproduce actual conditions on a reduced scale, he advises the battery immediately by radiophone what correction to make and another salvo is fired. Spotting from the air is found to be far more accurate than from the fighting top of a battleship, and with the installation of plane launching devices on our fighting ships it will not be long before every ship of the navy has its quota of trained flying spotters who will co-operate with the gun crews of his ship.—*Aviation*, 19 June, 1922.

LIGHT CRUISER ARMAMENT.—We understand that the *Diomede*, our latest completed cruiser of the "D" class, differs from other ships of her class in having the 6-in. gun at bow and stern mounted in a closed turret instead of behind an open shield. This has been done apparently to obviate the effect of interference from the superposed guns, from which, in earlier ships, the blast is deflected by an overhang screen; but the closed turret may also have been adopted to improve the protection of gun and crew. In the light of war experience it is difficult to justify the retention of open shields for the main armament of cruisers. At Jutland several of these vessels on both sides were practically put out of action, so far as fighting power was concerned, by a few salvos of high-explosive shells, splinters from which laid low most of the guns' crews at their exposed positions. The *Southampton*, the *Dublin*, and the *Chester* were cases in point. No doubt the adoption of gun houses in place of shields would mean a considerable addition in weight, which is an all-important factor in light cruiser design, but this difficulty could be met to some extent by mounting the guns in pairs, instead of singly. It might be advisable even to reduce the number of guns, if by so doing the armament could be better protected, for there is little doubt that a crusier with eight guns all mounted in turrets would be a better fighting ship than one which carried twelve weapons behind shields.

In the latest foreign designs effect has been given to this principle, for the American *Omaha* class have all their guns completely protected by turret or casemate armour, and the new French light cruisers are reported to have their eight guns mounted in turrets. In our own service a certain prejudice exists against the twin turret for quick-firing guns, due to the unsatisfactory working of this system in the old *County* class; but it should not be impossible to design a twin turret which would give adequate protection against all but heavy direct hits, without interfering seriously with the rapid and easy working of the guns inside. In any case the effects of modern shell-fire on personnel in exposed positions are so terrible that it seems the wisest policy to make some sacrifice of handiness and rate of fire in order to ensure that the gun crews shall be able to fight their weapons without being struck down by the first shower of splinters.—*Naval and Military Record*, 14 June, 1922.

RADIO AND NAVIGATION

SUBMARINE CABLE TRANSMISSION.—A recent paper published by the *Journal* of the Franklin Institute deals with the experiments of Frederick

E. Pernot in an attempt to develop a method of signal transmission over submarine cables which would permit of a more effective use of existing cable systems. By this scheme signals are transmitted by means of alternating currents simultaneously with the normal battery, or direct-current, operation of the cable. Currents of several different frequencies may be used, reserving a given frequency for each message, and by tuning or equivalent methods at the receiving end these messages may be separated, so that the simultaneous transmission of a number of messages is rendered possible. Actual trial of the proposed alternating-current method was made covering distances up to approximately 700 kilometers with results which are said to be completely satisfactory.

U. S. RADIO COMPASS INSTRUCTIONS.—The most recent and probably the most valuable aids to navigation in a fog are the radio compass stations, developed by the U. S. navy and maintained by the U. S. naval communication service for the benefit of mariners generally and U. S. coastwise shipping, particularly.

The naval communication service will furnish radio bearings to mariners of all vessels equipped with radiotelegraph transmitters.

While the use of these bearings should not lead a mariner to neglect other precautions, such as the use of the lead, etc., during a fog, these bearings will greatly reduce the dangers to navigation for mariners who are compelled for any reason to proceed during foggy or misty weather.

These radio compass stations are provided primarily to assist the mariner in closing the land during fog or poor visibility, but they may also be used to obtain the positions of vessels at sea in radio compass range, about 150 miles, when for any reason positions can not be obtained by other means.

The maximum distance for which bearings from these stations are accurate is 150 miles. But accurate positions can not be plotted when more than 50 miles from the shore on Mercator charts, for the Mercator projection introduces a distortion of the true bearing. Charts based on the Gnomonic projection are essential to plot correctly long-distance radio bearings.

Such charts are now under construction by the Hydrographic office; until they are available mariners may use the Mercator chart for long-distance bearings, applying necessary corrections which may be obtained by various methods, one of which is fully explained on the backs of H. O. pilot charts of the North Atlantic Ocean for February, 1921; North Pacific Ocean for May, 1921; Indian Ocean for June, 1921; and Central American Waters for March, 1921.

Radio compass stations are divided into two classes:

(a) Single stations, operating independently and furnishing a single bearing. These stations are located with the view of giving service to ships at a distance of not over 150 miles from the station.

(b) Harbor entrance groups. All stations in harbor entrance groups are connected to and controlled by the master station; all stations of the group take bearings simultaneously and these bearings are transmitted to the ship requesting them by the control station. The purpose of these stations is to lead mariners to the light vessels off harbor entrances.

Where only one radio compass station is available, the mariner may fix his position by two or more bearings from the station with the distance run between, or may use the bearings as a line of position, or as a danger bearing. Or the bearing may be crossed with a line of position obtained from an observation of an astronomical body to establish a fix.

The following stations are within the continental limits of the United States:

ATLANTIC COAST

Bar Harbor, Me.	Cape May, N. J.
Cape Elizabeth (Portland), Me.	Cape Henlopen, Del.
Gloucester, Mass.	Bethany Beach, Del.
Deer Island, Mass.	Hog Island, Va.
Fourth Cliff, Mass.	Virginia Beach, Va.
North Truro, Mass.	Poyners Hill, N. C.
Chatham, Mass.	Cape Hatteras, N. C.
Surfside (Nantucket), Mass.	Cape Lookout, N. C.
Prices Neck, R. I.	North Island, S. C.
Amagansett, L. I.	Folly Island, S. C.
Fire Island, L. I., N. Y.	Jupiter, Fla.
Sandy Hook, N. J.	Key West, Fla.
Mantoloking, N. J.	

GULF COAST

Pass a Loutre, La.	Grand Island, La.
Burwood, La.	

ALASKAN COAST

Cape Hinchinbrook	Soapstone Point

PACIFIC COAST

Cattle Point, Wash.	Point Reyes, Calif.
Smith Island, Wash.	Bird Island, Calif.
New Dungeness, Wash.	Point Montara, Calif.
Port Angeles, Wash.	Farrallon Island, Calif.
Tatoosh, Wash.	Point Arguello, Calif.
Ocean Park, Wash.	Point Hueneme, Calif.
Fort Stevens, Oreg.	Point Fermin, Calif.
Empire, Oreg.	Point Loma, Calif.
Eureka, Calif.	Imperial Beach, Calif.

CANADIAN RADIO COMPASS STATIONS.—The following radio compass stations are maintained by the Canadian Government and keep watch and take bearings on the 800-meter wave length:

CANADIAN AND NEWFOUNDLAND COASTS

Radio Compass Station	
Chebucto Head, N. S.	Cape Race, N. F.
Canso, N. S.	St. John, N. B.

—*Pilot Chart of North Atlantic Ocean*, July, 1922.

DIRECTIVE RADIO-TELEGRAPHY AND NAVIGATION.—In foggy weather sound-signalling stations have proved useful as an aid to navigation. The sounds heard, however, cannot be trusted to give accurate indications either of the distance or direction of the station. Their range is also very limited. It is not surprising therefore that many suggestions have been made, says *Nature*, for utilizing the electric waves used in wireless telegraphy to enable a navigator to find his bearings.

The propagation of electric waves is unaffected by fog and, unlike sound or light waves, can be transmitted to any distance. Moreover, the apparatus required for radio-signalling is very cheap, requires little skilled attention and can easily be installed in lighthouses. Until two or three years ago the radio-beacon—or the radio-phares as they are called abroad—were purely stations for giving ships their positions.

In order to find its bearings a ship must send a message to two or more stations and its direction is located by direction-finding coils. The stations then communicate with one another and so, by the help of triangulation, find the position of the ship, which is communicated by wireless. In practice the whole operation takes about five minutes. The most extensive chain of direction-finding stations is that controlled by the United States Navy. There are at least thirty stations on the Atlantic seaboard and several on the Pacific Coast. France has about ten radio phares and

Great Britain six. A drawback to this method is that valuable time may be lost in getting into communication with the radio-beacons and in getting the information back to the ship.—*The Nautical Gazette*, 17 June, 1922.

USE OF RADIOPHONE BY SMALL BOATS.—Personnel from the U. S. Naval Academy installed a small radiophone transmitting set on the referee's boat at the Poughkeepsie Regatta on June 26, and thus kept the Navy "rooters" at the finish line in constant touch with the start and progress of the race. Although this installation was in the nature of an experiment, it amply demonstrated the possibilities of the radiophone in following this particular branch of sport, and for communicating between small boats up to a distance of four or five miles. The antenna used was about thirty-five feet in length, while the battery, etc., weighed about 150 pounds.

EDITOR.

MISCELLANEOUS

THE "MAJESTIC," WORLD'S LARGEST LINER, MAKES ITS FIRST VISIT TO NEW YORK.—The White Star liner *Majestic* docked in New York for the first time in May. Not only is she the largest liner afloat, but she will very likely continue to have this distinctive position for some time to come. The *Majestic* is the result of the prewar competition for size and speed in transatlantic liners, and with the altered economic conditions and present high constructional costs, her equal will probably not be built for some time. Interest in the *Majestic* was doubless increased by the fact that her sister ship, the *Leviathan*, (formerly the *Vaterland*) had recently been sent to Newport News to be refitted for transatlantic traffic.

Originally built to the order of the Hamburg-Amerika Line at the Elbe shipyard of Blohm and Voss, Hamburg, and christened the *Bismarck*, work on her was well in hand when the outbreak of war came, and was continued till about the middle of 1916. After that time little progress was made, and about that period all copper pipes were removed and replaced by pipes of steel, which have for the most part been retained.

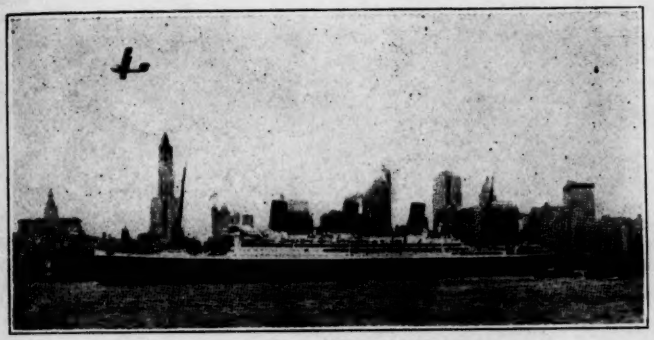
By the Versailles Treaty it was provided that vessels under construction should be completed by the Germans as designed and handed over to the Reparations Commission. The *Bismarck* was one of some twenty-five ships allotted to Great Britain, representing a gross tonnage of 225,000 tons. The White Star line purchased the *Bismarck* from the Reparation Commission, and renaming her the *Majestic*, began nearly a year ago to supervise her completion.

The *Majestic* has an overall length of 956 ft., and is 100 ft. broad, with a gross tonnage of over 56,000 tons, and a displacement of 64,000 tons when loaded to her marks. Her height from keel to boat deck is 102 ft., and the look-out man in the crow's nest is perched 180 ft., above the water line. A special feature in the design of the *Majestic* is the arrangement of her decks. Above the five steel decks, which run from end to end of the ship, there are four steel-plated erection decks which cover at least half her length. The boiler casings, instead of passing up the centre of the vessel, are divided and placed towards the sides of the ship, and are then carried up above the top deck, where they unite to form a center superstructure for the funnels. This method, which is adopted for two of the funnels—the third being a dummy funnel—permits of better ventilation for the boiler rooms, and from an architectural point of view admits of great breadth in the disposition and size of the cabins and public rooms throughout the seven decks on which most of the first-class passenger accommodation is provided.

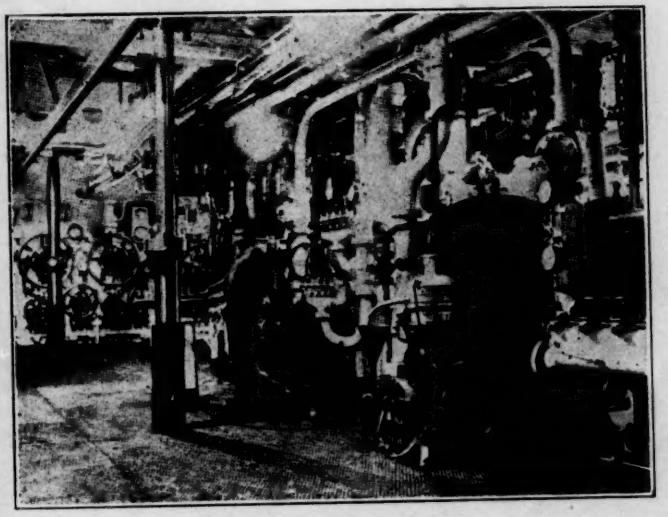
The full complement of the *Majestic* is over 5000 persons, this number including 850 first-class passengers, 545 second-class passengers, and 2392 third-class passengers, with a crew of over 1100.

The *Majestic* is driven by four-bladed propellers, each with a one-piece boss, made by the Manganese Bronze Company, Ltd., of London. Fig. 2 shows one of the spares. The propelling machinery consists of quadruple turbines of the combined-impulse and reaction type, Curtis wheels being fitted before the Parsons drums. The turbines are arranged in two engine rooms on the port and starboard.. The steam enters the high-pressure turbine on the port inner shaft, and passes on to the intermediate-pressure turbine on the starboard inner shaft, from where, equally divided, it again passes to the two low-pressure turbines on the outer shafts. Each separate shaft, however, is available for running or maneuvering by itself, but under ordinary working conditions the two low-pressure turbines operate in parallel. The total ahead horsepower is 66,000, and the astern power 36,000. According to contract, the vessel should travel at a speed of 23 knots when loaded to a mean draft corresponding to a departure draft of 35 ft. 6 in., and when the turbines are developing 66,000 shaft horsepower at a speed of 180 r.p.m., with a boiler pressure of 235 lb. per sq. in. On her run from Cuxhaven to Southampton she actually developed over 70,000 h.p. and a speed of 25 knots was reached. The astern turbines are subdivided into high-pressure and low-pressure turbines, and the low-pressure turbines are again placed on the outer shafts. By-pass valves are provided whereby high-pressure steam may be supplied to the other turbines, should at any time excess steam warrant this procedure. Thrust blocks of the ordinary pattern are provided. The turbines exhaust into pear-shaped condensers, and Weir's dual air pumps are installed. The turbine controls are all worked from a special control station (see cut) placed above the engine rooms, and all the main valves are hydraulically operated and electrically controlled. The boiler installation consists of 48 water-tube boilers of the Yarrow-Normand type, which are fitted with oil burners working on the White low-pressure system. The boilers, accommodated in four boiler rooms, are designed for a working pressure of 250 lb. per sq. in. The combined heating surface is over 219,000 sq. ft., and the total grate area exceeds 4000 sq. ft. The boilers are fitted throughout with Mumford's patent automatic feed controls. Aft of the main engine room is an outer engine room, containing 5 A.E.G. turbo-generating sets, each having an output of 280 kw. A large central switchboard is provided, from which the lighting and power requirements of the ship may be controlled. Current is supplied to over 15,000 electric lamps, in addition to various motors. On E. deck there is a special 70-kw. emergency dynamo, driven by an A.E.G. two-stroke cycle opposed-piston type engine of the Diesel type, with two vertical cylinders, which, along with its generator, is completely enclosed. The emergency set supplies current for the lighting and wireless installations, and also provides power for the six 20-hp. motors which operate the Welin boat-handling gear.

The system of telegraphs and telephones installed throughout the ship is very complete. Among the former may be mentioned the engine telegraphs, the starting telegraphs and rudder telltale, also the docking and anchor telegraphs, the boiler-room telegraphs and the distant revolution telegraph. A loud-speaking telephone system is installed for operating the ship and for communication between the engine and boiler rooms, and this system is so arranged that any boiler room can speak to any other boiler room or to the engine rooms and the engineers' department. Communication between the look-out man in the crow's nest and the bridge is established by a loud-speaking telephone in addition to the ordinary telephone. The ordinary telephone system for executive and departmental use has its own central exchange, which may be connected to shore when the vessel is berthed.



THE WHITE STAR LINER "MAJESTIC"



TURBINE CONTROL STATION

There are three wireless stations, and the largest is capable of maintaining permanent connection with both continents during the whole of the voyage. A smaller station is used for communication over a distance of 800 miles, and a subsidiary one is reserved for use in case of an emergency. In addition to the usual signalling arrangements, special provision has been made to guarantee as far as possible the safe navigation of the vessel in fog. Submarine signalling gear has been installed, and the Willett Bruce electric fog bell and whistle fitted. The fire-alarm system includes some 450 fire alarms, distributed throughout the ship, which automatically indicate to the officer on watch when the temperature in any compartment has been exceeded. This system is centralized on the navigation bridge, and is combined with a smoke-detection device, consisting of lines of tubing through which air may be drawn. Other signals which are shown on the navigating bridge are the water-tight door indicators and the cooling-room door telltales. Electric clocks are fitted throughout the vessel. Every precaution has been taken to reduce as far as humanly possible dangers which might arise in case of fire or collision, and an ample complement of lifeboats is carried, including two motor lifeboats fitted with wireless. All boats are swung out and lowered on the Welin system, which, as previously mentioned, is electrically operated. A somewhat novel fitting is the Fram night lifebuoy, which may be instantly released from the bridge by electrical means. Fram anti-rolling tanks are also fitted in addition to the usual bilge keels. (Description of the *Majestic* taken from *The Engineer*, vol. 133, no. 3463, May 12, 1922, pp. 522-523.)—*Mechanical Engineer*, July, 1922.

CURRENT NAVAL AND PROFESSIONAL PAPERS

"Bearing Metals"—*The Engineer*, June 2, 1922.

"When Steel Beams Stretch"—A new instrument for observing and photographing stresses in iron and steel—*Scientific American*, July, 1922.

"The Electric Propelling Machinery of the *San Benito*"—*Engineering*, June 16, 1922.

"Cunarder *Bercuzania* Converted to Oil-Fuel Burning" (illus.)—*The Marine Engineer*, June, 1922.

"Electric Welding," etc., by A. T. Wall—*Industrial Management*, June 1, 1922.

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"Accuracy of Airplane Bombing"—*The Journal of the Royal Artillery*, June, 1922.

"The Future of our Minor Armament"—*Journal of the United States Artillery*, June, 1922.

"The Archies and the Anti-Aircraft Service"—*Journal of the United States Artillery*, June, 1922.

NOTES ON INTERNATIONAL AFFAIRS

FROM JUNE 5 TO JULY 5

PREPARED BY

ALLEN WESTCOTT, Professor, U. S. Naval Academy

HAGUE CONFERENCE ON RUSSIA

CONFERENCE ORGANIZED.—The conference of European powers on Russian affairs met as planned at the Hague on June 15. Previous to the conference there was a sharp exchange of notes between Great Britain and France as to the policy to be pursued by the Allied Nations. France advocated agreement on a common program beforehand in order to present a united front and prevent a repetition of the Genoa failure. Great Britain, on the other hand, declared that to prepare a complete program for the rehabiliation of Russia and present it to the Russians as an ultimatum would be to make a travesty of the conference. Great Britain also upheld the right of any sovereign state to control the disposition of private property within its limits, to which France replied that the principle should have a different application in the case of a bankrupt state unable to pay for property seized.

Before the arrival of the Russian delegates, Foreign Minister Van Karnebeek of Holland, who presided, divided the conference into three sub-committees of eleven members each on Russian debts, foreign property, and credits. Great Britain, France, Italy, Belgium, Japan, and Holland had one member on each committee, the other members being distributed among the smaller states. It was decided by a majority vote, France alone opposing, that there should be no effort to agree upon a common policy before the arrival of the Russian delegates. France acquiesced on condition that she should be free to quit the conference at any time.

FRENCH AND BRITISH PREMIERS CONFER.—Premiers Poincaré and Lloyd George met in London on June 19. Action regarding German reparation payments was postponed pending investigation and report by the Reparations Commission as to what Germany could do to improve her finances without a foreign loan. It was agreed that at The Hague the experts should simply submit results to their respective Governments, who would be free to accept or reject. Plans were made for another conference in July over the Near Eastern situation and also with Spain over the Tangier question.

ARRIVAL OF RUSSIAN DELEGATES.—The Russian delegates to the Hague Conference, headed by M. Litvinoff, arrived on June 26. As the Russian delegation refused to divide into sub-commissions, after the fashion of the non-Russian delegates, the plan was adopted of having the Russians as one body meet the three sub-commissions in turn. While the Russian demands, as compared with those made at Genoa, were somewhat abated, they were still insistent upon a promise of credits from foreign powers and a long moratorium on Russian debts. The non-Russian delegates on the other hand called for definite statements as to the condition of Russian finances, the intentions of Russia in the matter of her foreign debts, and the purposes for which credits if granted were to be used.

RUSSIAN TRADE AGREEMENTS WORTHLESS.—Another declaration bearing on the Russian policy of the United States was made tonight by Secretary of Commerce Hoover in discussing trade with Russia. It came as confirmation of the conviction that there would be no change in the attitude of this Government toward the Hague conference or the question of having dealings with the present Bolshevist régime.

Mr. Hoover went at some length into the economic conditions in Russia, and said that the trade agreements which had been made with the Soviet by Great Britain, Germany, Italy and other countries were futile. Americans, he contended, had suffered no loss by holding back and refusing such agreements.

Russia, said Mr. Hoover, is without means of trading in commodities and is rapidly approaching economic paralysis. A day's ration of food in Russia in April, he said, cost 1,000,000 paper rubles, and the time was coming when the paper money would no longer buy and when, in the absence of precious metal, all business would have to be done by barter.

The American problem where Russia was concerned, said Mr. Hoover, was not that of trade, but that of investment.

"The feasibility of investing capital in Russia," Mr. Hoover added, "depends essentially on the policy of the Bolshevist Government and on the general internal situation, and not in any important degree upon action of foreign Governments."—*N. Y. Times*, 12/6.

GERMANY

BANKERS FAIL TO AGREE ON LOAN.—The committee of international bankers which met in Paris under the auspices of the Reparations Commission to consider plans for a loan to Germany adjourned on June 10 for three months. The adjournment without action was attributed to failure on the part of the Reparations Commission to give the bankers definitely a free hand in regard to recommendations for reduction of the German indemnity. In the Reparations Commission the proposal to extend this privilege to the bankers was favored by Great Britain, Italy, and Belgium, but opposed by France. In view of French opposition, the bankers decided that nothing could be done at this time.

Bluntly put, the Allies are betting on the United States finally coming to cancellation of the allied debts to the Washington Government. Certainly, the bankers' findings lend force to their argument. It is true the bankers did not go into a discussion of the interallied debts, largely because J. P. Morgan refused on the ground that he held no mandate from the

American Government. Yet any one who followed the talks of the eminent financiers knows they really gave deep consideration to the factor of the interallied debts. There is almost no argument which can be used for reduction of the German indemnity which does not apply to interallied indebtedness, with the possible exception of that of England.

The desire of France to avoid being drawn into a maneuver directed against the United States is one of the reasons invoked by the semi-official Temps today for the refusal of the French Government to approve of an international loan to Germany conditional upon a reduction of the German debt.

"France," says the Temps, "must not join in a combination which, by subordinating an international loan to a reduction of the German debt and a reduction of the German debt to cancellation of American claims, would appear like pressure upon the American Government by the European nations for the former to renounce what is due it.

"We believe the European nations should collaborate for the purpose of paying their debts and not of repudiating them. We hope our attitude will be understood at Washington, and if some of the representatives of the United States favor and counsel other Governments of Europe to adopt another policy they are not in accord with the Department of State."—*New York Times*, 10 June, 1922.

BERLIN FINANCES EXAMINED.—On June 16 the Committee on Guarantees appointed by the Reparations Commission left for Berlin to begin the work of arranging for supervision of the receipts and expenditures of the German Government and for a statistical statement of German finances. At the same time the Reparations Commission sent a new note to Germany, emphasizing in particular the matter of a forced internal loan, the covering of the budget deficit, and the autonomy of the Reichsbank.

FOREIGN MINISTER RATHENAU MURDERED.—Foreign Minister Rathenau, leading figure in the Wirth Cabinet and representative of Germany at Genoa, was assassinated in Berlin on June 24. The murderers fired from another car into the Foreign Minister's automobile and hurled a hand grenade which exploded with terrific force. Evidence indicated that the murder plot was carefully worked out by nationalist secret organizations by whom Rathenau was doubly hated as a Jew and as a leading advocate of the fulfillment of Germany's treaty obligations.

IRELAND

RESULTS OF PARLIAMENTARY ELECTION.—Elections for the new Irish Parliament which is to act upon the Anglo-Irish Treaty and the new Irish Constitution were held without serious disturbances on June 16. The result was a decided strengthening of the Pro-Treaty Coalition, as indicated by the following figures given out on June 21.

Pro-Treaty Coalition	55	Trinity College	4
Anti-Treaty Coalition	33	Farmers	6
Labor	15	Undecided	9
Independents	6	Total	128

The labor and independent vote is counted in support of the treaty.

NEW IRISH CONSTITUTION.—Negotiations in London between Irish and British cabinet members resulted satisfactorily in June, and a draft of the new Constitution was published on June 15.

The proposed Consitution of the Irish Free State declares itself to be "the Constitution of a free democratic state." It puts into form and substance the agreement known as the London Treaty. Constitution and Treaty alike set up in Southern Ireland a Dominion known as the Irish Free State which in all its broad principles and in many details conforms to the Dominion of Canada and is part of "the British Commonwealth of Nations"—a phrase used purposely in the Constitution instead of "the British Empire." It is a very modern form of government, for it contains provisions for woman suffrage, proportional representation, a referendum, and the power of initiative. It exempts the Free State from participation in foreign war except with the consent of its own Parliament or in case of actual invasion; it provides for freedom of religion and conscience and contains what is equivalent to a bill of rights. The Free State may maintain its own army, and it is pointed out that this goes further than is the case with Canada, which acknowledges the supreme command of military forces to rest with the Crown. The Free State will have an Executive Council, appointed by its Governor-General, but the council will be responsible to the Irish Chamber of Deputies, which corresponds to our House of Representatives, and the President of the council, who will really be a premier, will be chosen by the deputies.

The points in the Constitution which have provoked most dissension from extremists are two. One relates to the oath of allegiance to be taken by the representatives; the other relates to the fact that appeal lies in certain matters from the Irish Government to the Crown; just the same thing exists in Canada, but the opponents of the provision point out that it is a dead letter in Canada, while they do not feel sure that it will be in Ireland. These and other objections are not fiercely urged, and, in general, the proposed Constitution seems to have met with almost surprising approval in Ireland itself.—*Outlook*, 28 June, 1922.

FREE STATE ATTACKS REBELS.—On June 26, Mr. Winston Churchill stated in the House of Commons that the British Government intended to call upon the Provisional Government of Ireland to suppress the rebellious faction of the Irish Republican army and carry out the popular will as expressed in the recent election. He also stated that British troops were to be used along the Ulster border to prevent violent measures against the Ulster government and that 50,000 stands of arms had already been sent over.

On June 28, the Free State Government began active measures against the Republican irregulars in Dublin and particularly against the forces in possession of the Law Courts under Rory O'Connor. Two days later the buildings were burned and battered down and the garrison forced to surrender.

INTERNATIONAL AGREEMENTS

NAVAL TREATY RATIFIED.—It was announced on June 12, that all the Washington treaties, with the exception of the Naval Treaty, would be ratified by the British Government simply by acts of the Privy Council without submission to either house. The Naval Treaty would be submitted indirectly in the form of an enabling bill to carry its provisions into effect.

The Japanese Privy Council ratified the Yap Treaty on June 21, and the Naval Treaty a week later.

OPPOSITION TO PALESTINE MANDATE.—On June 21 the British House of Lords condemned the terms of the British Palestine mandate by a vote of 60 to 29. The opposition claimed that the mandate made Great Britain responsible for a Zionist political predominance in Palestine where 90 per cent of the population was non-Zionist, and that it would give rise to bitter hostility on the part of the Arabs.

In reply the Earl of Balfour, in his first speech in the House of Lords, declared it was impossible otherwise to establish a Jewish home in Palestine and that ample safeguards were provided for the Arab population.

FAR EAST

NEW JAPANESE CABINET.—On June 11, Admiral Baron Kato accepted the Premiership of Japan, his one condition being a reduction of the army budget to 40 million yen and adoption of a general policy of military retrenchment. The new cabinet is expected to have the support of the Seiyukai majority party in the Diet and a majority also in the upper house.

Kato's policy is stated in general to be favorable toward ratification of the Washington Treaties and toward a foreign policy of peace and friendly relations between Japan and China.

Tokio, June 12 (Associated Press).—The Cabinet of ex-Premier Takahashi, smashed through opposition to his liberal ideas, has been succeeded by one whose announced watchword is economy and which, a portion of the vernacular press declares, has tinges of reactionarism.

These comments, directed so far chiefly at the new Premier, Admiral Baron Tomosaburo Kato, who took office today, are reinforced by others leveled at his policy of naming a non-party Government. Most of the Ministers have seen service in former Cabinets or in other governmental positions. Two, besides Kato himself, are retained from the Takahashi Ministry—Viscount Uchida, who holds the Foreign Affairs portfolio, and Enkichi Oki, Minister of Railways.

EVACUATION OF SIBERIA.—On June 28, the Japanese Diplomatic Advisory Council set October 30 as a definite date for withdrawal of Japanese troops from the maritime province of Siberia. Whether this decision will be accepted by the military authorities in Japan remains to be seen. The decision in any case would not affect the northern part of the Island of Sakhalin, which Japanese forces hold pending satisfaction for the Nikolaievsky massacre.

CONTINUED FIGHTING IN CHINA.—In spite of the report of an armistice between General Wu Pei-fu's victorious forces and those of the Manchurian leader Chang Tso-lin, the latter attempted a surprise attack on June 11, and during the week following was driven northward toward Mukden after heavy fighting.

Li-Yuan-hung, former President of the Republic, agreed to accept the office once more in an effort to establish a unified government. Dr. Wu

Ting-fang, former Minister to Washington and prominent South China leader, was offered the premiership on June 11 but refused to accept. It was reported that Dr. Wellington Koo, ex-Minister to the United States, was slated for the Ministry of Foreign Affairs.

In the South, President Sun Yat-sen of the Canton Government refused to resign and thus clear the way for the reunion of China under one rule. On June 18, however, the Canton President was forced by one of his mutinous generals to leave the city and take refuge on one of the five Chinese gunboats in the harbor.

NEAR EAST

TURKISH FRONT STABILIZED

The Allied military observers held a conference at Constantinople during last week, dealing with the military situation on the Asia Minor front. It is said the consensus of opinion was that no serious military campaign was likely to be launched this Summer by either the Greeks or the Turks.

The Greeks have great numerical superiority on the front line, but the opinion is that the superiority is not sufficient to justify an offensive in view of the difficulties of the terrain. The present Greek force includes 110,000 rifles, while the Turks number 70,000. The Turks also are inferior as regards equipment, although they have received considerable supplies during the last six months from two important sources which the allied observers decline to name.—*New York Times*, 19 June, 1922.

LATIN AMERICA

CHILI-PERU ARBITRATION.—During June the conference in Washington between Chili and Peru over the Tacna-Arica question was in deadlock, Peru offering to arbitrate the general question whether or not a plebiscite should be held in the disputed territory, and Chili consenting to arbitrate only the conditions to govern the plebiscite. It was anticipated that Secretary of State Hughes would attempt to end the deadlock by seeking a common ground upon which the two parties would agree to arbitration by a neutral power.

MEXICAN DEBT AGREEMENT.—On June 16, Minister of Finance de la Huerta of Mexico signed in New York an agreement with Thomas W. Lamont, Chairman of the International Committee of Bankers on Mexico, providing for resumption of interest payments on the Mexican debt on January 1 next, with further provision for completion of payments of back interest by January 1, 1928. In return, the bankers' committee agreed to "recommend that the bond holders make substantial adjustments of their rights,"—in effect cancellation of most of the back interest. The total debt is estimated at about $500,000,000, with $200,000,000 arrears in interest.

Huerta later held conferences with representatives of oil companies operating in Mexico over the question of a government taxation and policy toward development of oil areas.